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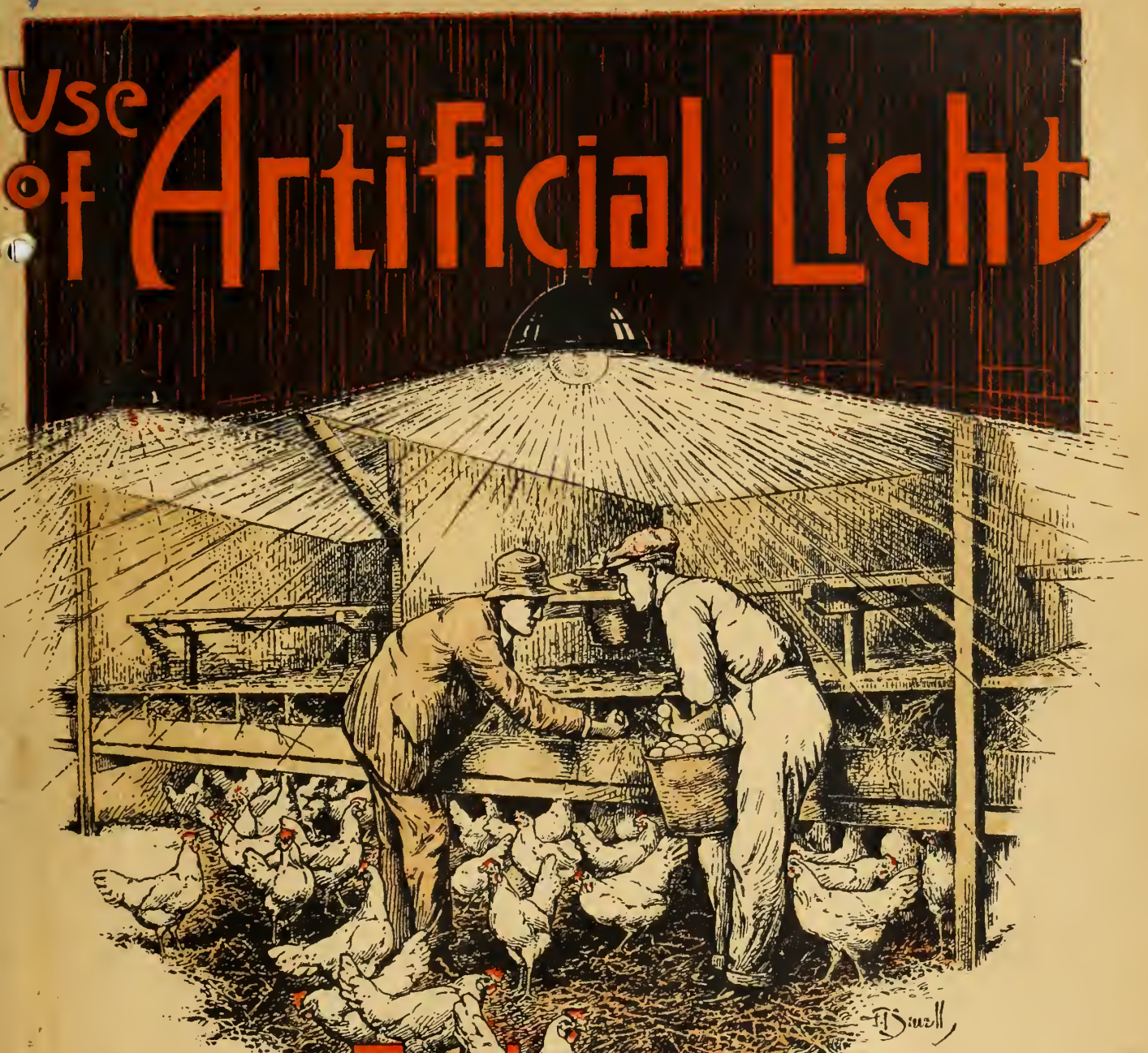
Use of Artificial Light



To increase Winter Egg Production

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USE OF ARTIFICIAL LIGHT TO INCREASE WINTER EGG PRODUCTION

Complete Account of the Discovery and Development of This Natural, Practical and Profit-Earning Method Which Enables Domestic Fowl To Feed and Function To Better Advantage In Northern Latitudes, With The Result That Their Egg Yield Can Be Increased Greatly During The High-Price Months of Fall and Winter

Compiled by
GRANT M. CURTIS
Editor Reliable Poultry Journal

Contributed to by George R. Shoup, Poultryman, Western Washington Experiment Station, Puyallup; By Jas. E. Rice, Professor of Poultry Husbandry, Cornell University, Ithaca, N. Y.; By Dr. E. C. Waldorf, Buffalo, N. Y. (First to Practice This Method); By Prof. Luther Banta, Poultry Instructor, Massachusetts Agricultural College; By R. S. Moseley, of Sunny Crest Farm, East Aurora, N. Y.; and By Other Well-Known Authorities, Including Numerous Practical Poultrymen and Commercial Egg Farmers.

*"The Principles Involved in our use of Artificial Illuminalion are not Mysterious. On the Contrary, they are quite self-evident and easy to understand. * * * * Now we come to this recenl use of Artificial Light lo lengthen the work-day of the Hen, or to equalize her time of work and time of resl in each twenty-four hours, and the results are astonishing—are truly revolutionary. They promise great things for the Poultry Industry on Commercial Lines. Not only are Commercial Plants to be greatly helped, but the benefits of this use of Artificial Illumination apply proportionately to farm flocks kept for egg produclion and can be utilized by the small Back-Yard Plant where a main object is to secure a liberal yield for the family table in the season of high prices."- Jas. E. Rice, Professor of Poultry Husbandry, College of Agriculture, Cornell University, Ithaca, N. Y.*

Fully Illustrated, Including Ten Color Charts from Cornell University, the work of Dr. and Mrs. O. B. Kent

PRICE $1.50

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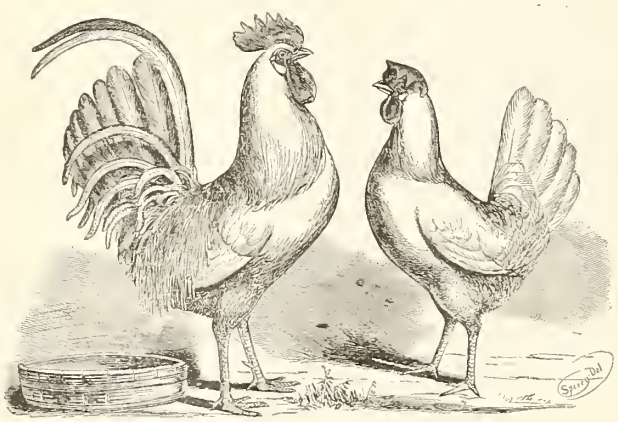
HISTORICAL

IT appears that to America, meaning in this case to the United States, belongs the credit of having discovered the practical use of artificial light to lengthen the workday of the domestic hen, thus to enable her to eat and digest more food during the short sunlight days of the year, to convert daily a greater amount of food into eggs and thereby largely increase her yield of this staple product during the period of usual scarcity when eggs for human consumption invariably are high priced. To the best of our knowledge the honor for this "sensational and revolutionary discovery"—to use the words of Prof. Jas. E. Rice, Cornell University—belongs to Dr. E. C. Waldorf, student of the natural sciences and a practicing physician of Buffalo, N. Y., who conducted experiments on this line, with several objects in view, as far back as 1889-1893 at Buffalo—see article by Dr. Waldorf, beginning on page 19 and later report beginning on page 64.

In compiling this book and handling to advantage the subject of which it treats, we were at a loss to know just



EXHIBITION WHITE LEGHORNS IN THE 70's

The male and female White Leghorns shown above are typical of the appearance of these fowls as they were bred half a century ago. These birds show characteristic alertness and sprightliness, but in shape and comb they are far from Leghorns as now bred.

how to proceed, but finally decided to present in its pages the whole matter in the order in which it has developed and been published in the columns of the Reliable Poultry Journal—doing this because it has been an orderly and connected development that embraces the facts, methods and advice which our readers will wish to know, and this plan has the merit of being extra interesting, as much so almost as a story would be of travel into some strange new country or upon unchartered seas. If the reader is as deeply interested in what he finds in this book as we have been in collecting and editing the wealth of material, we shall feel well repaid.

To W. H. Reynolds, Braintree, Mass., goes the honor of having furnished the Reliable Poultry Journal the first article it ever published on the subject of the use of artificial light. This article is reproduced complete herewith, including illustrations, beginning on page 17. Said article was first published in the April, 1911, issue of R. P. J. By reference to Mr. Reynolds' article it will be learned that he began these experiments in the season of 1910-11, using a 40-Watt Tungsten electric lamp and that they were remarkably successful—a fair index of what was to follow.

But as before stated, it appears that the historical credit for first discovering and using this method with signal success belongs to Dr. Waldorf. His first article on the subject was published in the February, 1915, issue of R. P. J., from which article these statements are quoted:

"I began my first attempt in forced egg production in December, 1889. These experiments were made on the premises of Patrick Kinney, 56 York St., Buffalo, N. Y. * * * * The proper length of daylight was provided by the installation of four 100-candle-power, Argand brass burners suspended from the first ceiling, one foot from the outside edge and five feet from the ground. Each burner was provided with a large reflector, throwing the light directly downward. These lights were controlled by an automatic time adjuster and were turned on at 3:30 a. m. and off again at 7:30. They were turned on again at 5 p. m. and off at 8 p. m. for the night. The results of these tests were published in the Clyde Times, Clyde, N. Y., in February, 1899, the complete daily record having since been mislaid or lost."

The following paragraphs are quoted from a later statement by Dr. Waldorf, as of date October 27, 1919, after he had refreshed his memory relating to experiments made by him twenty-five to thirty years previous and had looked up the records, talked with old neighbors, etc.:

"Before my experiments of forced egg production by the use of artificial lighting were concluded in 1893-1894, many well-known and prominent Buffalonians became enthusiastic about the matter. I will mention the names of the following who personally watched the system at that time:

"Frank T. Reynolds, Superintendent of Board of Public Works, Buffalo, then living at 52 York St.

"Daniel Mahoney, New York State flour salesman for Gold Medal Flour. Residence 62 York St., Buffalo.

"George Chambers, Superintendent Maintenance Department, Buffalo Water Works.

"Edward Howard, senior member of Howard Bros. Chemical Co., Buffalo, N. Y.

"M. B. Daly, President, East Ohio Natural Gas Company, Cleveland Ohio, then Superintendent of Buffalo Natural Gas Fuel Company, who gave permission for gas service to the poultry coop.

"John Walsh, Superintendent of Service Department of Buffalo in 1892 and still in same capacity, who approved the application for gas supply to my hen coop in 1893.

"A. W. Gavin, foreman of service for Buffalo Natural Gas Company in 1892 and still in same capacity, who piped the gas to my hennery, 56 York St., for heat and illumination, early in 1893.

"My experiments were begun in 1889 and conducted rather free from the public eye for four years, but by 1893 my work in this line was no longer a secret, as every one of the gentlemen named, from personal observation and knowledge, now testify. The practical application of the system with full equipment may be stated as having been publicly under operation in 1893.

"While the system at that time proved a success commercially, the greatest benefit, as I felt, was the relief from unhatchable eggs by eliminating their slow forma-

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tion, which unquestionably is detrimental to normal germ life within the egg before laying and during incubation. This much accomplished, all that remained to be done in order to select the hatchable egg was to learn the required density, as shown by specific gravity test."

Discovery of Lighting System in the Northwest

Mr. and Mrs. George R. Shoup, poultry specialists, Western Washington Experiment Station, Puyallup, Wash., probably did more from 1912 to 1917 than anyone else in the United States—which means the world in this case—to develop and promote the use of artificial light for increasing egg production, carrying on this work with success in the Northwest, whence it extended southward into California, notably around Los Angeles. However, it was not until the season of 1911-1912 that Mr. and Mrs. Shoup made their first trial of the use of artificial lighting—see article beginning on page 31, also latest statement from them, page 95 of this book. In Prof. Shoup's latest statement he says:

"The first trial of our artificial lighting of poultry was on a rather limited scale. During the summer of 1911 we had managed to raise some three hundred pullets in fireless brooders. * * * * Our rule in those days, when the land had to be cleared, shingle bolts cut, and firewood made, was to do no work in the daylight which could be done just as well by lantern light. Cleaning the droppings boards was a job that fell among the lantern-lit class in the morning. This pre-daylight performance had the additional advantage of keeping the eggs much cleaner, as the birds would fly from the roosts clear to the floor without wanting to jump on the droppings boards and soil their feet.

"We had noticed for several days that quite a bunch of pullets would follow up the lantern and endeavor to find grain in the litter, and had on several occasions placed the light on the floor for a few moments just to humor the biddies, which of course were very tame because of frequent handling in the trap nests. Time was precious, however, and the one lantern was needed to clean more coops before breakfast and to get the oats out of the sprouter and distribute them through the coops so that the birds could eat as soon as it was light enough.

"So, when in the course of a Sunday visit, our old English neighbor suggested, in a vein of humor, that we 'give the bloomin' 'ens lantern light to h'eat breakfast and supper by', it gave us the necessary hint. We hung the lanterns (the brightest barn lanterns we could buy) in various places, both high and low, to the rear and to the front of the coop, shifting them three at a time to try out the different positions, and finally nailed up tin reflectors on the front foot-wide upright coop supports about two inches from the floor and hung one lantern in a place.

"We found it necessary to have the lanterns trimmed and lighted as early as three-thirty in the afternoons, our days were so dark. As a precaution against fire, the lanterns when lighted were left on the workbench fifteen or twenty minutes, to make sure the flame did not rise, blacken the chimneys and possibly come out of the top to the danger of adjacent woodwork.

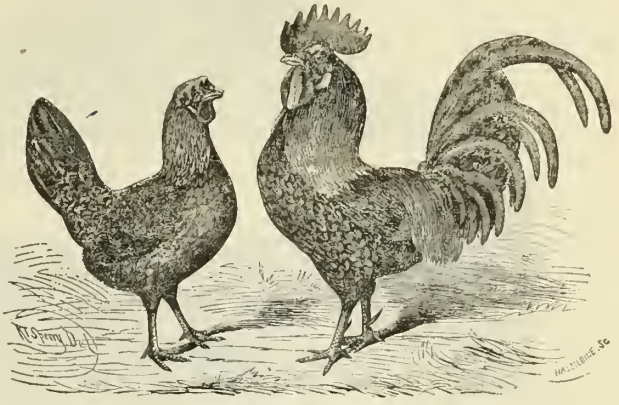
"The birds were so evidently pleased with the new arrangement that we could hear them singing long after dark, and in ten days' time from the purchase of the lanterns we had the pleasure of informing our poultry-news dispenser that our production was up to 200 eggs per day, and the country was saved."

Prof. Luther Banta, Department of Poultry Husbandry, Massachusetts Agricultural College, Amherst, contributed an important series of articles to the pages of R. P. J. on this subject (beginning on page 33 of this book) from which we quote as follows, relative to the discovery and early use of artificial light to increase egg production:

"Prof. Jas. E. Rice, of Cornell, while doing Farmers' Institute work in northern New York state about twenty years ago (which carries the matter back to 1898—Ed.) ran across a poultryman who had used electric light to increase the length of his hens' feeding days in winter and as a consequence had observed a marked increase in their egg production. To the best of my knowledge it is not known when or how he obtained the idea or suggestion which led him to try the experiment. Probably it was original with him. The fact that he was the owner of the local electric light plant, doubtless explains the reason why he ventured to spend money on what must, at that time, have been considered a foolhardy scheme.

"A poultryman connected with one of the large Leghorn farms in New Jersey wrote me last winter that over twenty years ago he successfully used lights to increase winter egg production, so we must conclude that it is not a brand new idea at all.

"Since these first tests many other poultrymen in widely separated parts of the country have carried on the good work in endeavoring to ascertain the real truth about this interesting problem. Another poultryman in northern New York used lights about fifteen years ago. In December of last year a poultryman in western New York state told me that he used lights in his laying house twelve years before when he was a resident in one of the suburbs of Liverpool, England. He had run a grocery business in the city, and being employed in the store in the early evening,



REPRESENTATIVE BROWN LEGHORNS OF FIFTY YEARS AGO

These birds, in their comparatively level carriage, more nearly resemble Leghorns as now bred, than do the Whites shown on opposite page, but they scarcely suggest the beauty of modern Leghorns.

he did not arrive home until ten or eleven o'clock at night. He went immediately to his poultry house, called the birds from their perches by means of lantern light, and gave them their evening meal."

An additional report of the early use of artificial light for this purpose comes from Jas. G. Halpin, Professor of Poultry Husbandry at the Wisconsin College of Agriculture, Madison. Writing us under date March 17, 1919, Prof. Halpin said:

"I believe I am the first experiment station worker to be guilty of trying this out on the hens. Back in 1906, over in Michigan, we started this and had splendid success with the artificial light, as compared with those birds with no light * * * My records and observations at that time were received with a great deal of amusement by my co-workers who seemed to agree with the daily press at that time that it was a joke * * * At the time, I supposed that I had run onto a brand new idea. A little later, however, I found that my idea was about as old as the hills—apparently another proof of the fact that there is nothing new under the sun. I was up in northern Michigan and there found a man who had been using illumination in his poultry house for years. He discovered it accidentally. His men came to the barn at 5 o'clock in the morning, fed the horses and cared for them. He noticed that the hens in the first pen laid more eggs than the hens in the other pens; that as soon as the lights were on, the hens in the first pen would get down and go to digging in the straw for something to eat * * * The name of this man has escaped me, but I remember that he had been practicing that plan for several years when I talked with him in the spring of 1907 or 1908."

This carries the historical question as far as we are able to at this writing. According to our best knowledge to date, therefore, the honor for first using this method belongs to Dr. Waldorf, of Buffalo, whose experiments started sometime in 1889 and were concluded in 1893. We have tried faithfully, with the help of Dr. Waldorf, to secure a copy of the Clyde Times, which contained the report of his early success, giving the egg yield, etc., but as might reasonably be expected, a file of that weekly paper, reaching back thirty years or more, does not now exist in the offices of publication, nor were we able to locate, in private hands, one or more copies of this weekly, as published back in 1889, or 1890.

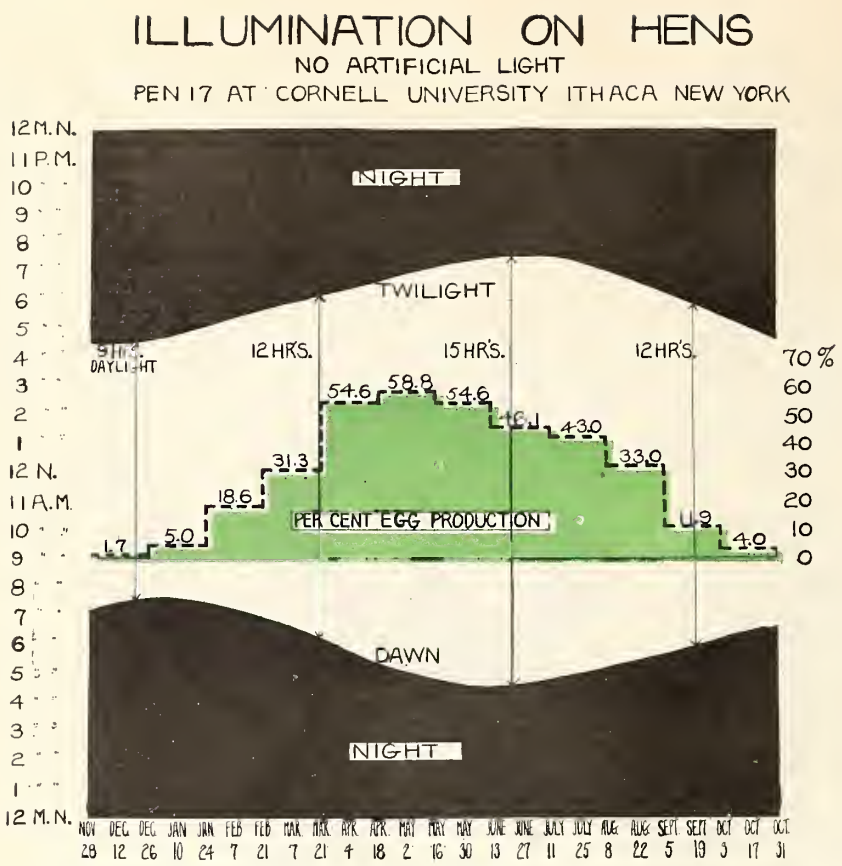
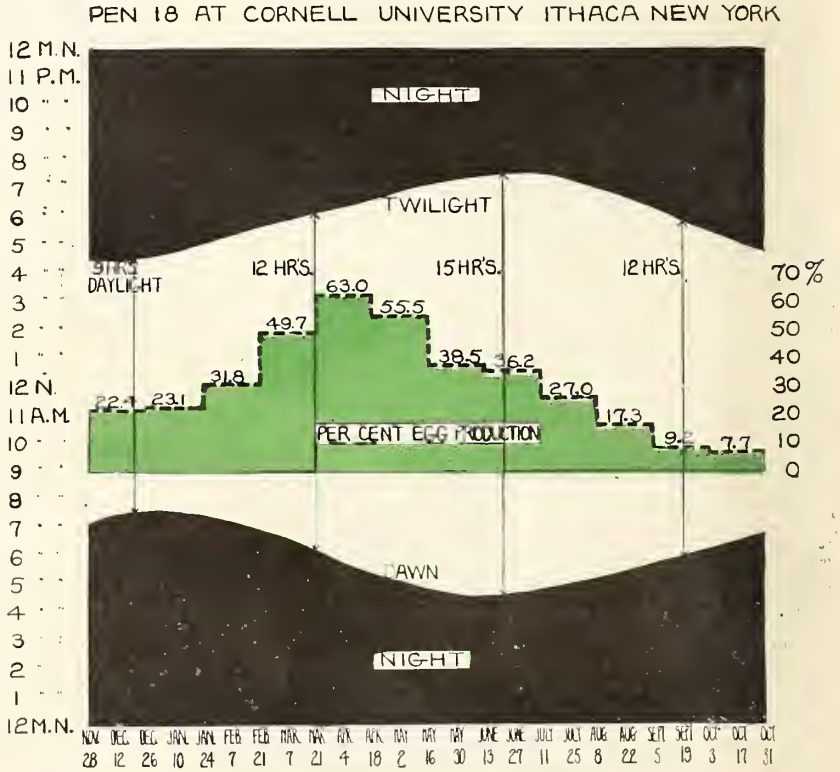


Plate I

Shows "check pen" of hens, using no artificial light, the dotted line giving the per cent production from November 28 to the following October 31st in four-week periods. Production starts with 1.7, mounts to 58.8, then falls to 4.0. Dates are shown along bottom, time of day on left side and percentages at right. Note that "flush season" of production for these not-lighted hens was from March 21 to about mid-June, with a reasonably good yield to the end of July. During September and October the per cent of production was again disappointingly low.

Plate II

Shows egg yield of "check pen" of not-lighted pullets, kept under same conditions as "check pen" of hens represented by Plate I. Production here, on November 28, starts with percentage of 22.4, reaches 63.0 by March 21, holds up well to middle of May, then steps down pretty steadily until it reaches 9.2 about September 1, giving only a small yield during that month and October when market prices are on the rapid increase. As a rule, well-matured pullets should lay 10 to 20 per cent more eggs than hens, across the year.



ILLUMINATION ON HENS

7A.M.–7P.M.

PEN 21 AT CORNELL UNIVERSITY ITHACA NEW YORK

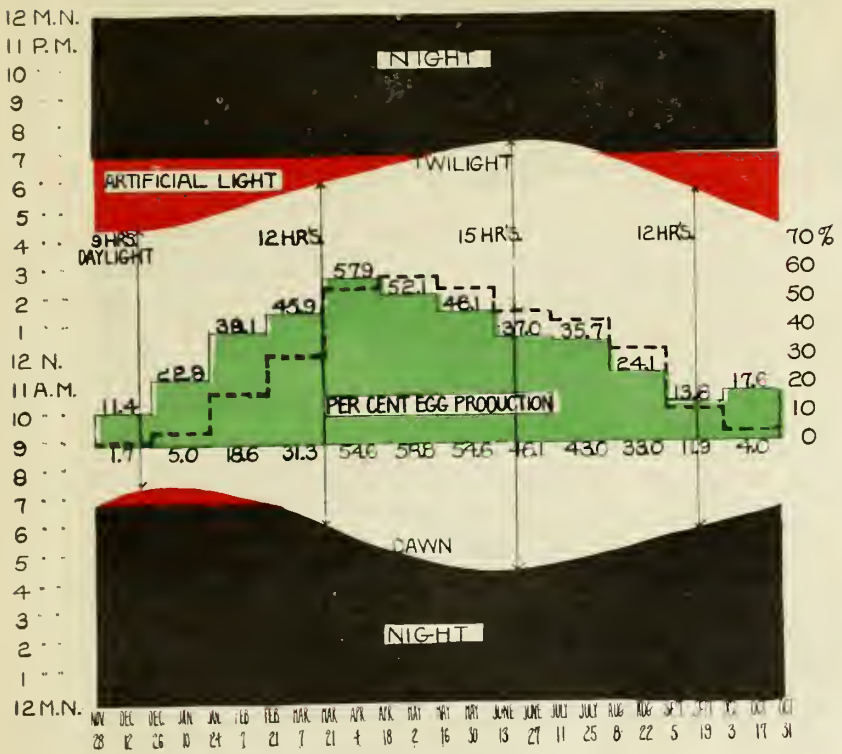


Plate III

White, in all these charts, shows natural daylight; black shows night, and the area in red the amount of artificial light" supplied to lengthen the so-called work-day of the birds. In the case of this pen of hens the lights (electric) were turned on at 7 a. m. from November 28 till about February 1, and again at 4 p. m. during the season when needed and were kept on till 7 p. m., thus to give the birds not less than a 12-hour work-day at all periods during the forty-eight weeks. Morning lighting for this schedule was required only during November, December and January, after which dawn arrived earlier.

ILLUMINATION ON PULLETS

7A.M.–7P.M.

PEN 22 AT CORNELL UNIVERSITY ITHACA NEW YORK

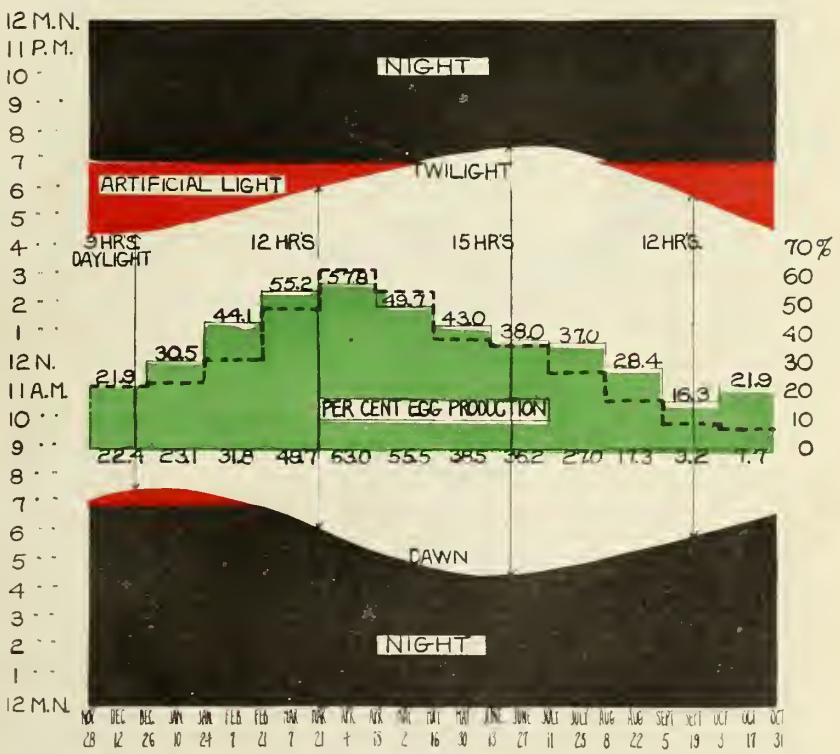
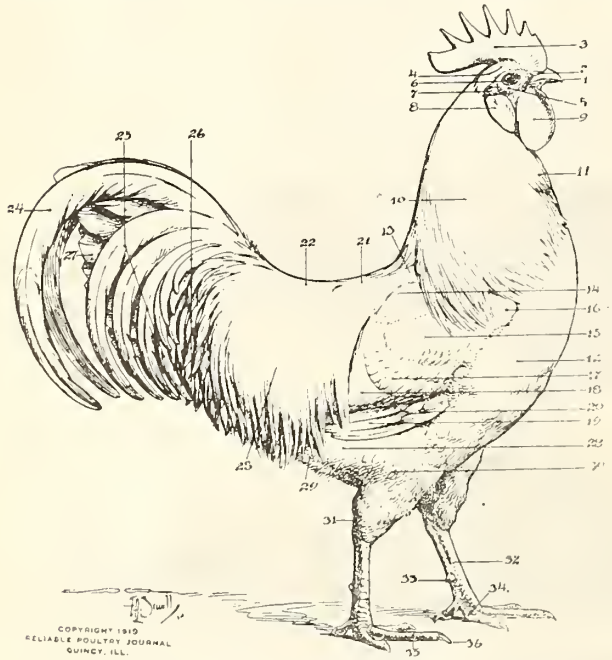


Plate IV

Shows same "light" treatment for pullets that Plate III does for hens. In these two plates and the next four following (pages 10 and 11) the "check pen" egg yield of hens and pullets respectively is shown by the dotted line superimposed on or over the "lighted pen" production—see actual percentages of not-lighted or "check pens" in figures along lower edge of green area. Where "lighted" yield was greater, the dotted line is on the green area; where less it extends above the green. Green, in each case, represents actual egg yield of pen.

AFTER the average person gets used to the idea of the use of artificial light to increase egg production, the first or main prejudice commonly met with is that it is a forcing process; that it means overworking the hens and therefore must result, sooner or later, in an injury to them, or in their physical breakdown. The welcome fact is that this fear is groundless, or practically so. Like almost anything else this plan can be overdone, but very seldom has been, so far as our investigations have gone and it is indeed surprising with what uniform success it has been used to date by all classes of poultry keepers, from the small plant backlotter to the big commercial egg farms of the Pacific Coast and in half a dozen or more eastern states, all of which information will be found set forth in reliable form in the following pages.

This use of artificial light to lengthen the workday of the hen during the fall and winter months in northern latitudes of the United States, Canada, etc., is really a feeding problem, so to speak, not a case of "forcing" the birds. Success, or good results, do not in this matter depend in any degree on condiments or on specially invigorating foods. The astonishing increases in egg yield are not even the result, primarily, of well-balanced foods, but are the natural and logical outcome of the longer workday in fall and winter, the longer period in each twenty-four hours of the calendar day for the hen to eat, exercise, digest, function, and convert surplus food into eggs. That truly is the foundation of the matter, the "why" of the welcome increase. Of course the other contributing conditions should exist, in order to get good, better, or best results, such as proper housing quarters, right care, correct feeding, the use of wholesome, well-balanced, egg-forming rations, etc., but even with all these factors present, if the "day" is too short—is cut down to seven or eight hours out of each twenty-four, the organism of the hen simply cannot do, in this short period, what it is prepared to accomplish with ease in twelve to fourteen hours, if given a fair chance.



THE SECTIONS OF A LEGHORN MALE

This drawing shows the outline of a typical modern exhibition Leghorn male. Compare with the males illustrated on pages 4 and 5 to note progress made in breeding. The different sections are numbered so that those unfamiliar with fowls can learn their proper names, which are as follows: 1—beak; 2—nostril; 3—comb; 4—crown of head; 5—face; 6—eye; 7—ear; 8—ear lobe; 9—wattle; 10—hackle (neck); 11—front of hackle; 12—breast; 13—cape; 14—shoulder; 15—wing bow; 16—wing front; 17—wing coverts, wing bar; 18—secondaries, wing bay; 19—primaries, flights; 20—primary coverts; 21—back; 22—saddle; 23—saddle feathers; 24—sickles; 25—smaller sickles; 26—tail coverts; 27—main tail feathers; 28—body feathers; 29—fluff; 30—thigh; 31—hock; 32—shank; 33—spur; 34—ball of foot; 35—toe; 36—toenail.

Strange as it may seem to persons with whom this idea or method is new, the healthy pullet or hen that is in right condition physically, actually wants to lay at this time of the year—during the fall and winter months. It is the one thing that such a pullet or hen most desires to do. The spring-hatched pullet by this time has reached the period for reproduction and the hen that has come through the molt is possessed with the same idea. Neither of them has any "thought" whatever of the market price of eggs for human consumption, or of filling the egg basket. What they specially wish to do is to respond to Nature's insistent demand for reproduction.

But mankind literally keeps these birds in captivity—has taken them into northern latitudes where the fall and winter days are so short that these comparatively small creatures usually go unfed—unreplenished—fifteen, sixteen, and in some cases as much as seventeen hours out of each twenty-four, while meantime they are in freezing latitudes and must fight against cold, for their very existence. As a rule, their one source of bodily heat, absolutely needed to sustain life, is from the chemical action of digesting and assimilating food; hence in the short days of fall and winter they do not have a surplus of food to convert into eggs for reproduction purposes, or any other use.

Now that we have made this discovery, the reasons, the causes are all plain enough. What a pity it is that we could not have anticipated these facts long ago, reasoning from cause to effect, or from effect back to cause and thus have secured this welcome increase in egg production each year, during the annual period of scarcity! Following are some of the noteworthy things that have been said and written quite recently on this phase of the subject—to t' ffect that the increase which is sure to result from l. hy, well-kept, well-fed hens by lengthening the workday of fall and winter is a natural process, is a feeding problem, not a matter of forcing or of overworking the layers.

Prof. Luther Banta (see pages 34, 35 herewith):

"Evidently there is a very close relationship between the number of hours of daylight during the various seasons of the year and egg production. Cornell University has charted the egg production of both countries (Australia and the United States) and finds that approximately the lowest production obtains during the shortest days and the heaviest production at or just previous to the longest days. This variation in length of day exceeds 40%." Continuing, Prof. Banta states—page 35:

"Also many of the winter days afford only about seven hours that are sufficiently light for the birds to see to scratch and eat freely. This means a minimum day over 54% shorter than the longest day in June, yet, in addition, this occurs at that time of the year when the

atmospheric temperatures range the lowest and consequently when the greatest demands are being made upon the reserve food nutrient supply of the bird in order that she may merely maintain her normal body temperature, which is very high, comparatively speaking, in a fowl, averaging 106 degrees Fahrenheit.

"Professor Halpin, who used lights in 1907 while in charge of the Department of Poultry Husbandry at the Michigan Agricultural College, examined the crops of fowl on the perches at midnight in midwinter and found them in all cases nearly or quite empty. Evidently a bird cannot possibly cram enough food into her crop at four-thirty or five o'clock in the afternoon to carry her through to the next morning's meal. In other words, she is only working on a part-time basis, as her mill (gizzard) is prepared to grind food continuously, but its output is necessarily limited by the capacity of the hopper (crop) supplying it.

"Therefore, 'lights' were tried to supplement the natural daylight hours sufficiently so that the hen might eat her evening meal at about eight o'clock in the evening, and likewise electricity was used to provide an early breakfast at about 6 a. m. By this method Prof. Halpin found the bird's digestive system was kept working through a greater portion of the day, that she accordingly consumed more food, and, as a consequence, had a larger supply of food nutrients available, was able to keep her body more adequately nourished and had a larger net balance of the necessary ingredients to manufacture eggs more freely. FOR GENERATIONS HENS HAVE WANTED TO LAY IN THE WINTER, BUT COULD NOT.

"Professor J. C. Graham, of the Massachusetts Agricultural College at Amherst, has observed that birds distend their crops with food to a greater degree in the fall and winter afternoons than during the spring and summer. Without a question this is a manifestation of the bird's endeavor to counteract the effects of the short winter day to the very limit of her ability, or capacity, in this relationship.

"The logic of the whole idea is so simple and based upon the most elemental laws of physiology and nutrition to such an extent, that it is astonishing that it has not become a matter of common knowledge and practice before, though it has been known and used by a few scattered poultrymen for many years."

Prof. Jas. E. Rice:

In an address at Chicago, July, 1918, Prof. Rice made the following statements with reference to the fact that it is natural for a hen to reproduce eggs under right conditions if given the chance:

"In this country, fowls come into laying from south to north, much as strawberries come into bearing. In Australia and New Zealand on the other side of the equator, the reverse is true. Our hens, when cold weather comes upon them, instead of going into a dormant condition, will respond at once in the way of egg yield, to favorable environment. If we can duplicate or maintain suitable conditions as to bodily health, length of day, etc., they will go on producing. In our country this statement refers to production during November, December, January and February, in the case of fowls that are old enough and that also are in proper condition, as to health and surroundings."

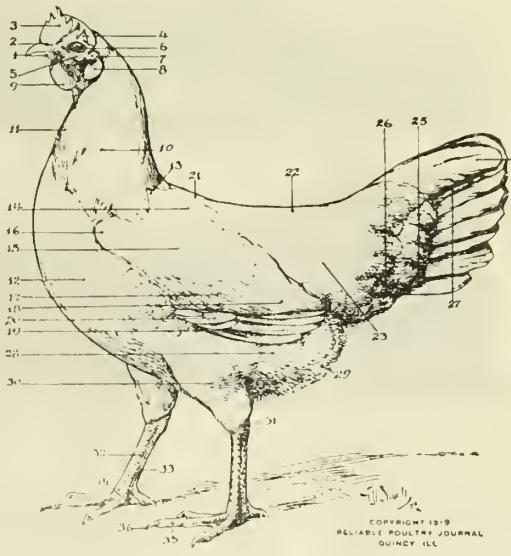
A year later, in one of two lengthy addresses (first of the two) delivered by Prof. Rice at the Judging and Breeding School, Cornell University, Ithaca, N. Y., July 7-12, the speaker said, in introducing his subject:

"Heretofore we have depended on the time of hatching, method of feeding, style of houses, etc., to increase egg production in the fall and winter or during the period of natural scarcity in this northern latitude, hence the period of high prices; but in these efforts we have met with only moderate results. For many years I have felt that if we could give our fowls what may be called hothouse conditions, as used for example by the florist, we could get eggs any time we want them—any time of the year. Lately, two great contributions have been made to the method of securing more profitable egg production. One is the successful culling out of nonlayers and poor layers from our flocks by the use of external characters and physical examination; the other is by the use of artificial illumination to increase the length of day during which the would-be layers, the ready-to-lay birds, can function and produce.

"The principles involved in our use of artificial illumination are not mysterious. On the contrary, they are quite self-evident and easy to understand. For example, it is easy to realize that the domestic hen, when kept in this locality, meaning central or northern New York, is out of her natural habitat and she is held here in what amounts to captivity. This fact hardly needs discussion. We know that the original domestic fowl was a native of the tropical zone and climate. For centuries, for ages, she was accustomed to practically a twelve-hour day and a twelve-hour night, on the average. These birds, having been developed under those conditions, possessed organs that were based on at least twelve hours of daylight, meaning in particular their digestive organs. Man picked up these fowls and carried them north to points like Ithaca, N. Y., where during five or six months of the year they have, on the average, a nine-hour day and a fifteen-hour night, also vice versa.

"When brought north these fowls were limited in choice as to what to do. About the only chance they had was to go on functioning the best they could and, as time passed, to adjust themselves slowly to the changed conditions of climate, length of day, etc. Such adaptations mean slow progress. Springtime breeding was continued, with little or no attention to winter egg production. These birds from the South simply adopted new habits, but did not change their physical form. When winter arrived, with the long cold night, they tucked their heads under their wings and ceased to lay till spring came with its longer days and warmer weather. They just hibernated or practically so, and waited for more favorable conditions.

"First—and until recently—man relied mainly on feeding and special breeding to get these hens to lay in the



THE SECTIONS OF A LEGHORN FEMALE

The beauty of the typical modern Leghorn hen is enhanced by comparison with the early type Leghorns shown on pages 4 and 5. The sections of the Leghorn female are as follows: 1—beak; 2—nostril; 3—comb; 4—crown of head; 5—face; 6—eye; 7—ear; 8—ear lobe; 9—wattle; 10—neck feathers; 11—front of neck; 12—breast; 13—cape; 14—shoulder; 15—wing bow; 16—wing front; 17—wing coverts, wing bar; 18—secondaries, wing bay; 19—primaries, flights; 20—primary coverts; 21—back; 22—sweep of back; 23—cushion; 24—top covert; 25—larger tail coverts; 26—smaller tail coverts; 27—main tail feathers; 28—body feathers; 29—fluff; 30—thigh; 31—hock; 32—shank; 33—spur; 34—ball of foot; 35—toe; 36—toenail.

fall and winter. Good housing and proper feeding will help, also breeding for egg production, based on vigor, high individual records, etc., but the response to all these efforts was not enough—did not make the keeping of layer-flocks on a commercial basis a profitable venture during the short-day period of the year, from September 1st to the following March 1st, taking the North Temperate Zone as a whole."

In this same connection we quote as follows from an article written in 1915 (revised and approved in 1919) by Mr. J. P. Jordan, New York City, N. Y., President of Sunny Crest Poultry Farm, Inc., East Aurora, N. Y.—see page 58, this book:

"Many joking comments have been made on working the poor birds overtime. But what if you had to go to bed at half-past three or four o'clock on a winter afternoon, your food all digested by ten or eleven o'clock at night, and then you had to huddle yourself up as best you could until half-past seven or eight o'clock the next morning before you could see well enough to work for your living? You, too, would soon become discouraged with life, contract all diseases born of weakness and fail to produce your share of the interests of life which you would otherwise produce if you were given the opportunity.

"IN THE OPINION OF THE WRITER, THE RESULTS OBTAINED FROM ELECTRIC LIGHTS IN A POULTRY PLANT ARE EXACTLY AND ONLY WHAT WOULD NATURALLY BE EXPECTED.

'More exercise, more feed—especially dry mash—more water by almost treble, and there follows these results: better health, stronger constitution, greater strength, and, lastly, the logical end of it all, namely—FAR GREATER EGG PRODUCTION."

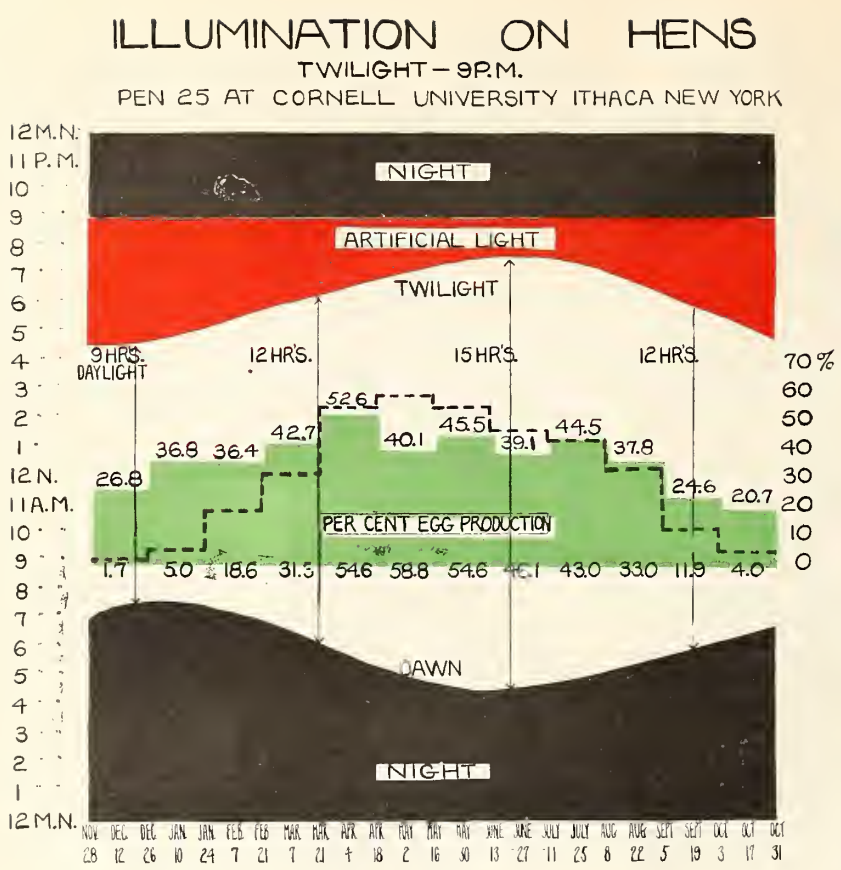


Plate V

Here, for hens, and in Plate VI for pullets, no artificial light was given mornings, but light was supplied from early twilight till 9 p. m. every day of the entire period. Observe the gain in egg yield as compared with the "check pen", also as compared with Plates III and IV respectively (hens with hens and pullets with pullets), also with Plates VII and VIII on page 11, in which latter cases the "lights" were used till 9 p. m. every day and also were supplied from 6 a. m. till dawn in the winter and fall.

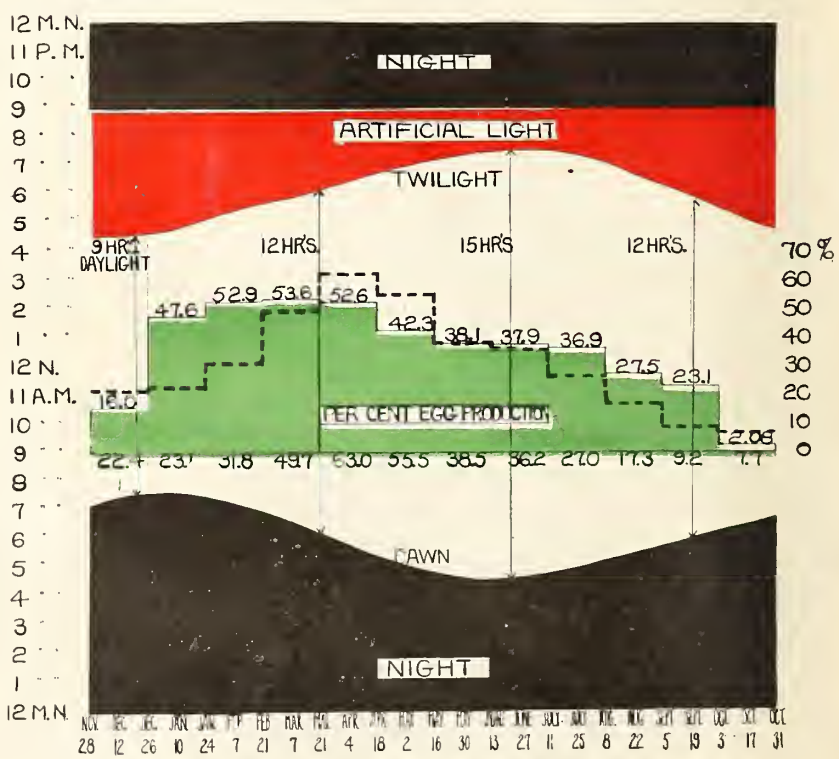


Plate VI

Observe in this case, also in that of hens in pen 25 (Plate V), that the egg yield was much greater during the high-price period of November, December, January and February, also during the good-price period of September and October, than it was from the "check pens" (Plates I and II) of similar birds not under lights. In both these cases (pens 25 and 26) the hens and pullets respectively "took a rest" in degree during the height of the natural "flush" and therefore low-price season — especially March and April.

ILLUMINATION ON HENS

6 A.M.– 9 P.M.

PEN 19 AT CORNELL UNIVERSITY ITHACA NEW YORK

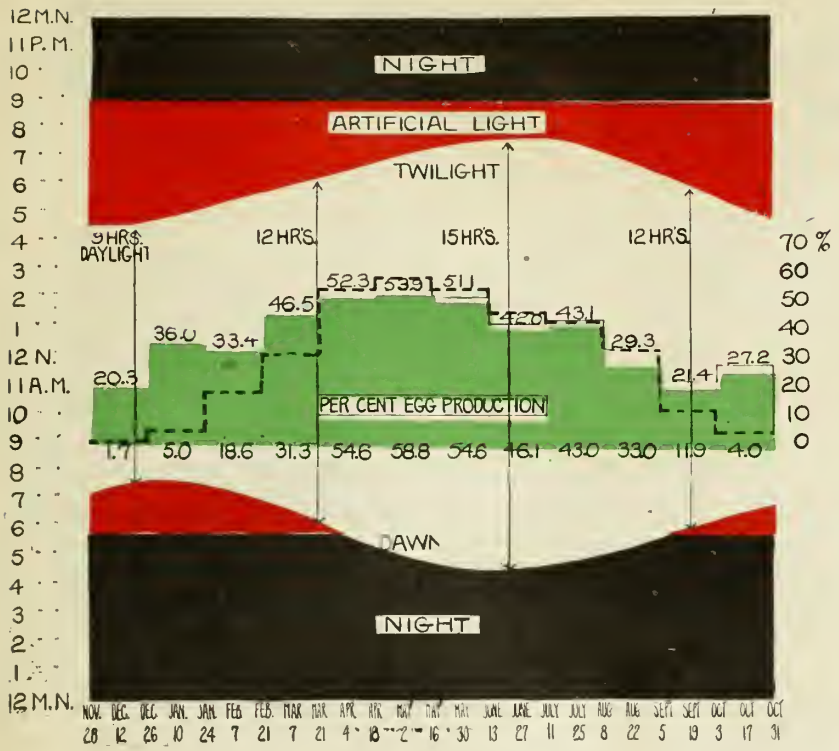


Plate VII

In this case, also in that shown by Plate VIII, artificial light was supplied every evening till 9 o'clock, also in the morning during the shorter natural sunlighted days, with the result that remarkable increases in egg yield were obtained during the high-price periods, November 28 to March 1, also during the good-price period that comes each year with August, September and October—a time when the great majority of kept-over hens are in the molt and when most pullets ordinarily are immature, hence not laying.

ILLUMINATION ON PULLETS

6 A.M.–9 P.M.

PEN 20 AT CORNELL UNIVERSITY ITHACA NEW YORK

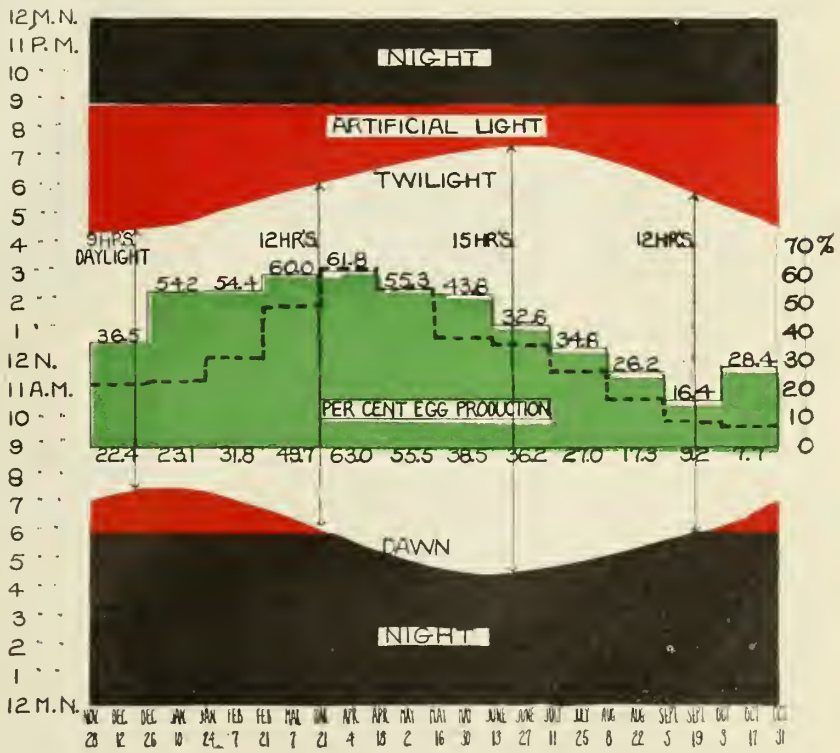
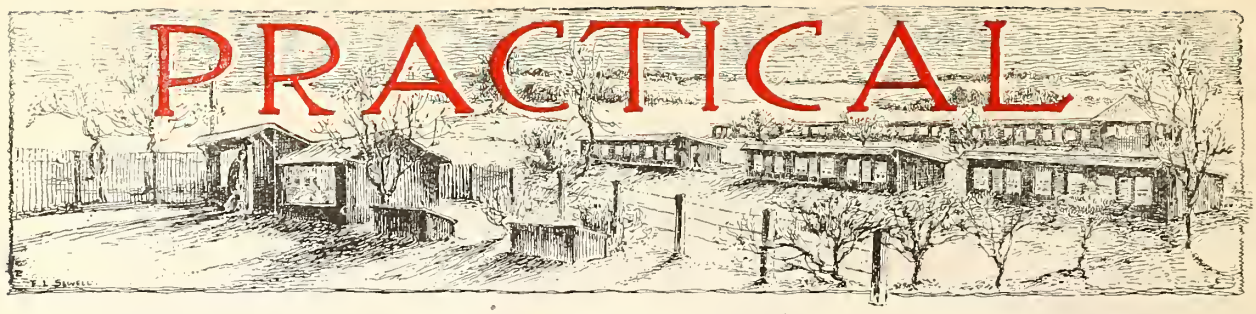


Plate VIII

By reference to this plate and Plate VII it will be observed that in these two cases, where artificial light was used both morning and evening, there was little or no falling behind in egg production during the natural "flush season", as compared with the "check pens" of hens and pullets respectively, and that the birds "under lights" greatly outlaid the not-lighted birds in the high and good-price periods and also about held their own the rest of the time, especially in case of this pen of pullets.



IN the opinion of the editor or compiler of this book the value and importance of the discovery of the use of artificial light to increase the egg yield of domestic fowl in northern latitudes during the short, sun-lighted days of fall, winter, and early spring, cannot well be exaggerated, so far as professional and alert amateur poultry keepers are concerned. This importance is certain to be National, in fact world-wide in scope, and of great economic or financial value. Far-seeing experts and students in the poultry field already are predicting serious trouble ahead in the annual storage of surplus eggs produced in the flush season of spring and summer. Our own view is that this method of adding to the supply of new-laid eggs each fall and winter will become widespread and uniformly successful, but that there still will be real need of and ample opportunity for the storage of surplus flush-season eggs, as produced on the average American farm by the usual indifferent methods as to time of year, small sizes, irregular gathering, mixed colors, etc.

But the word "practical" as used at the head of this chapter relates more particularly to the "where and by whom" phases of the subject. That word as here used is meant to refer to the situation or possibilities set forth in the quotation from addresses by Prof. Jas. E. Rice, as they are presented in the panel on the title page of this book, to the effect that the use of artificial light for the purpose of increasing egg production, especially during the high-price season or seasons of each year, can be employed successfully and to important financial advantage by all classes of poultry keepers—by back-lotters, by owners or managers of egg plants, small or large, and also on ordinary farms where fowls are kept in considerable numbers.

That is the "practical" use or value we have in mind just here, and we feel that it should be duly emphasized in the opening pages of this book. We could quote at length on this branch of the subject, but shall go only far enough to give these facts the prominence they well deserve.

As regards back-yard poultry keeping and the profitable use of artificial lighting, special attention is directed to the reports by Warren V. Clarke, Buffalo, N. Y., as they begin on page 21 and page 32. From Mr. Clarke's article entitled, "Successful Use of Lighting in Back-Yard Plant", beginning on page 21, the following quotation is made:

"The 'secret' of the heavy winter egg yield that I obtain is THE USE OF ELECTRIC LIGHTS night and morning, thus giving the chickens a longer day in which to consume food. I find that you can feed them a less concentrated food by elongating the day. Of course, no success can be attained unless the fowls are given reasonable care, the proper kind and quantity of food, plenty of drinking water, and suitable quarters. These conditions would insure the health of the fowls. It is, of course, highly desirable that the birds you keep should have been bred for egg production.

"The lights are turned on at 5:30 a. m. and switched off at 7:15 to 7:30 p. m. Of course, as soon as the daylight is strong enough they are switched off until three or four in the afternoon, depending on the brightness of the day. The lights are used from October 1st to April 1st with pullets, but with yearlings or breeders they are used from August to February 1st, the hens being rested during February and March so the eggs will hatch well during the rest of the spring and early summer.

"Another advantage in using electric lights is that the chickens can be attended to after supper for the following day. The grain feeders and mash hoppers can be filled, likewise the nonfreezing water founts. The only labor, which is a pleasant task, is gathering the eggs."

Next we refer the earnest reader to the report by writer entitled, "Further Facts About Use of Lighting System in New Jersey", which is begun on page 75, from which report the following examples of large increases in production are published as obtained from the carefully kept records of Mr. Victor G. Aubry, extension specialist of the poultry department at the New Jersey Agricultural Experiment Station, New Brunswick:

"Again referring to his notes and records, Mr. Aubry said: 'Here is another case, that of Mr. A. W. Ramsey, who is located in Bergen County, in the northern part of the state. It develops that Mr. Ramsey for several years has tried this lighting system on a few pullets, about fifty in number, but previous to this year (1918-1919) he had not followed up the matter systematically and with a feeling that he was using just the best methods of feeding and care. You might class Mr. Ramsey as a back-lotter. Poultry with him is both a side-line and a diversion—a pleasant one. Lately he reported that unless something unforseen turns up, he never again will keep pullets over the winter unless they are given the artificial light.'

"Following is the yield obtained by Mr. Ramsey during last fall and winter:

"September 1, 1918, to March 15, 1919, the lights being turned on September 1st: September 1-7, 4; September 8-14, 7; September 15-21, 8.1; September 22-28, 8; September 29-October 5, 7.5; October 6-12, 8; October 13-19, 14; October 20-26, 22.4; October 27-November 2, 23.1; November 3-9, 22; November 10-16, 21.4; November 17-23, 28; November 24-30, 34.4; December 1-7, 38.1; December 8-14, 42.6; December 15-21, 44.5; December 22-28, 48; December 29-January 4, 49; January 5-11, 51.2; January 12-18, 51; January 19-25, 50; January 26-February 1, 48.9; February 2-8, 47.4; February 9-15, 48; February 16-22, 48.9; February 23-March 1, 51; March 2-8, 52; March 9-15, 54."

VINELAND HEN No. 106

White Plymouth Rocks, first to last, have proved to be good layers—especially so for a medium weight breed. Above is a photographic reproduction of the White Plymouth Rock hen which, in her pullet year, laid 301 eggs in trap-nests at the Vineland International Laying and Breeding Contest—year ending October 31, 1917—the only bird in 1,000 in this contest that reached the 300-egg mark in 365 consecutive days.

(Note—In noting these high percentages of egg production and many others that occur in this book, the reader will do well to bear in mind that pullets and hens which are not "under lights" produce, as a rule, about 10 to 20 per cent in egg yield, October 1st to the following March 1st in northern latitudes. In central and southern New Jersey the average yield for well-kept not-lighted birds is about 20 per cent for this period of the year.—Ed.)

Continuing, Mr. Aubry said:

"Here are the reports of Mr. Fred Naylor, who lives in the western part of Monmouth County. He is another beginner who has used artificial illumination in his houses with surprising results, although he attributes a good deal of his success, as regards his first winter's production, to the good stock he obtained and to the fact that he grew his young stock on a range where poultry never before had been kept, yet he credits most of his phenomenal fall and winter egg production to the fact that he used lights."

"Following is Mr. Naylor's production from pullets, the flock consisting of 840 birds, on the average:

"September 1-7, 12; September 8-14, 17; September 15-21, 24.3; September 22-28, 37; September 29-October 5, 39; October 6-12, 43.4; October 13-19, 44.6; October 20-26, 45; October 27-November 2, 44.1; November 3-9, 41.4; November 10-16, 40.3; November 17-23, 40; November 24-30, 45.4; December 1-7, 46; December 8-14, 53; December 15-21, 56; December 22-28, 62; December 29-January 4, 64.3; January 5-11, 60; Jaunary 12-18, 58.9; January 19-25, 59; January 26-February 1, 61; February 2-8, 62; February 9-15, 60.1; February 16-22, 58; February 23- March 1, 56; March 2-8, 51.5; March 9-15, 52."

309-EGG R. I. RED HEN

This S. C. R. I. Red (Sanborn strain) laid 309 eggs in trap nests in one year.

Next Mr. Aubry furnished us the results obtained by two general farmers. Referring to these reports, Mr. Aubry said:

"Also here are reports from two general farmers. I refer to John H. Miller and to Wm. Wilson, both located in the western part of New Jersey along the Delaware River. They raise poultry as an important side-line. This is especially true of Mr. Miller, who carries about 600 birds. Apples are his main crop. Both of these men however, have realized the importance of poultry when properly cared for and therefore are giving their hens the opportunity they ought to have. After having used the lights this last winter on their flocks, they have become more enthusiastic than ever in regard to poultry keeping and in future will make this work what might be called 'a main side-line' on their general farms. Both of these men used gasoline lanterns to light their pens.

"Mr. Miller's egg production from 600 S. C. White Leghorns (we do not know the proportion of pullets and hens) September 1, 1918, to April 1, 1919, was as follows:

"September 1-7, 8.1 (lights turned on September 1st); September 8-14, 11; September 15-21, 14; September 22-28, 16.2; September 29-October 5, 20.3; October 6-12, 20; October 13-19, 21.8; October 20-26, 23; October 27-November 2, 24.5; November 3-9, 28.7; November 10-16, 30.8; November 17-23, 35.4; November 24-30, 43.4; December 1-7, 48.6; December 8-14, 54.4; December 15-21, 56.8; December 22-28, 58.4; December 29-January 4, 54.1; January 5-11, 52.4; January 12-18, 54; January 19-25, 53.2; January 26-February 1, 59.5; February 2-8, 57.3; February 9-15, 54.1; February 16-22, 56.3; February 23-March 1, 52.4; March 2-8, 53.4; March 9-15, 51.4; March 16-22, 48.6; March 23-March 30, 53.4.

"Mr. Wilson, the other general farmer referred to by Mr. Aubry, who kept 200 S. C. White Leghorn pullets, obtained the following production, September 1, 1918, to April 1, 1919—lights turned on September 1st:

"September 1-7, 5; September 8-14, 8; September 15-21, 12; September 22-28, 20; September 29-October 5, 25; October 6-12, 32; October 13-19, 31.5; October 20-26, 30.3; October 27-November 2, 30; November 3-9, 35.3; November 10-16, 43.2; November 17-23, 47.1; November 24-30, 54.3; December 1-7, 57; December 8-14, 62; December 15-21, 61.2; December 22-28, 56.1; December 29-January 4, 51.3; January 5-11, 56.1; January 12-18, 58.1; January 19-25, 63; January 26-February 1, 68; February 2-8, 61.2; February 9-15, 62; February 16-22, 61.5; February 23-March 1, 58; March 2-8, 56; March 9-15, 53; March 16-22, 54.1; March 23-30, 52.3."

Additional to the foregoing, Mr. Aubry presented similar reports from large market egg plants located in New Jersey. The results obtained on the egg plants were as good, but really no better in the way of high percentages than those secured almost without exception by backlotters and general farmers. Numerous such cases are reported throughout this book. Said Mr. Aubry in conclusion:

"It is but right to state that in New Jersey this past fall and winter, I have known of only one case in which there was disappointment in the use of lights. In that case everything was going fine until the owner of the flock decided if 'more light' was good, then still more ought to be better, so the hens were kept at work or off the roosts for about eighteen hours out of the twenty-four, with the result that pretty soon they went all to pieces, so far as production was concerned. Twelve to fifteen hours per day appears to be all the birds will stand and do well, judging by prolonged tests and reports in this state to date."

Following is a further quotation from an address made July 7-12, 1919, by Prof. Jas. E. Rice, before the Judging and Breeding School of Cornell University, Ithaca, New York:

"A Remarkable, A Revolutionary Discovery"

"Here we have a remarkable, a revolutionary discovery or advancement in poultry culture. If it is as good as it seems, and I believe that it is, we can afford to proceed carefully, within reason. Such results as these hens and pullets have given us under lights—especially where the lights were turned on at 3 a. m., are absolutely astonishing. They seem 'too good to be true', and yet this table is accurate; these results are ACTUAL, and I think you will agree with me in the use of the word 'revolutionary' in describing such remarkable production. (See full report of this address, beginning on page 83). What the results might have been if these fowls had been truly high producers, consisting of birds bred-in-line for prolific egg yield, I am not prepared to say. Naturally, we ought not expect more than one egg a day per hen, hence the financial benefit to the average poultryman in the use of lights will be greater per bird from average layers and moderately good layers than from the really high-production individuals. Yet, no doubt, by 'lighting' our birds during the short-day period of each season we can get the maximum supply of eggs two, three, or four months earlier, as compared with past achievement, and these excess eggs in the fall and early winter will bring us twice the amount in cash, which to date has been about the general rule, where lights have been used properly.

A 313-EGG BARRED ROCK

This Parks' strain hen laid 313 eggs in 12 months, completing the year on December 1st. She continued laying until the total number reached 327 before stopping finally to molt.

Description By Professor Rice of the Ten Colored Charts

EXPLANATORY LEGENDS TO BE STUDIED IN CONNECTION WITH COLOR PLATE ILLUSTRATIONS ON PAGES 6, 7, 10, 11, AND 15; GIVING RESULTS OF EXPERIMENTS IN ILLUMINATION FOR THE CONTROL OF EGG PRODUCTION, AS MADE AT THE NEW YORK STATE COLLEGE OF AGRICULTURE, CORNELL UNIVERSITY, ITHACA, N. Y.

By JAMES E. RICE, Professor of Poultry Husbandry

PLATES I and II attempt to illustrate the amount of daylight and darkness each month of the year in New York State and the way the length of the night and the day influences the normal distribution of egg production throughout the year in the case of hens and pullets.

Plates III to X show the way various methods of providing artificial illumination influence the distribution of egg production with hens and pullets.

In the first eight illustrations the same graph is used to display the periods of daylight and darkness, since the flocks under experiment were observed for the same length of time—namely, from November 4th, 1917, to October 31st, 1918, a period of forty-eight weeks.

It will be seen that in representing the periods of night and day on a flat surface it is necessary to divide the periods of darkness at midnight so that reading the hours of the day and the night on the left of each graph, from the bottom up, one can determine the changing time of dawn and twilight for each period of the year. If this is done it will be noticed, as shown by the arrows, that on the shortest day, December 21st, the daylight is approximately nine hours and the darkness approximately fifteen hours long and that on the longest day, June 21st, the exact reverse is true, namely—a fifteen-hour day and a nine-hour night, and that on March 21st and September 21st the nights and the days are equal—twelve hours each—which is approximately the condition each day of the year near the equator where the domestic fowl is supposed to have originated.

BARRED PLYMOUTH ROCK HEN No. 17 Laid 272 Eggs in One Year.

BARRED PLYMOUTH ROCK HEN No. 19 Laid 278 Eggs in One Year.

These farm-grown, grade-value, Barred Plymouth Rocks made the high egg records given above, doing this in year beginning November 1, 1916, the first year of the three-year Vineland Egg Laying and Breeding Contest, conducted at Vineland, N. J., under the direction of the Poultry Department of the New Jersey Agricultural Experiment Station, New Brunswick. Birds had been line-bred only three or four years for high egg production. Shows what can be done in this direction. Birds did not have the benefit of artificial light.

Assuming that the periods of the year in New York state when the nights and the days are essentially equal are the most favorable for production, it naturally follows that during midsummer the fowls have longer periods of daylight than they normally require and that during the midwinter they have shorter periods of daylight than they should have for efficient egg production.

The distribution of egg production is shown in Plates I and II, the dotted line giving the per cent production for each four-week period and showing that the expanding period of daylight increases production and contracting periods of daylight decrease production, with both hens and pullets. In the case of hens the contrast is more pronounced than it is with pullets. This is due to the fact that the hens, at the beginning of the second or later years of laying, will have laid out their production during the preceding year and generally are not fully recuperated and ready to start a new cycle of laying when the adverse conditions of cold weather and shorter days of the fall arrive, whereas the pullets, if they were hatched so as to begin laying normally in September or October (in New York state) have by that time stored up enough nourishment to produce a considerable number of eggs even under the adverse fall conditions, as shown in the case of hens, Plate I, and pullets, Plate II.

Results of Three Different Methods

How three different methods of supplying light influence egg production on hens and pullets is shown in Plates III, IV, V, VI, VII, and VIII. Both the hens and the pullets used in these tests were under the average in quality, having been left over after the other college teaching and experiment project needs had been provided for. However, the birds in all of the pullet pens were essentially similar, as were the birds in the hen pens. The birds in all of the eight flocks were fed the regular Cornell rations, and the other conditions, such as the kind of houses, the kind of pens, light, wattage, etc., were as near similar as it was possible to make them.

Plates III and IV show, by the area in red, the amount of light given, namely—7 a. m. until dawn and from twilight until 7 p. m. This, it will be seen, was sufficient to make a perceptible increase in production during the first five months and the last month, in the case of the hens, and a somewhat similar increase in the case of the pullets during the second, third, fourth, and last five months. The age and condition of the pullets apparently was such that the amount of illumination given was not sufficient to make a marked increase in production.

In Plates V and VI will be seen the distribution of production where the light was given from twilight until 9 p. m. during the entire time of the experiment. Thus there was so sudden break or gradual decline in the amount of artificial light given, as is usually the case in actual practice during the late fall and early spring months when artificial lighting normally is started and stopped. Undoubtedly the light was not required in summer.

ILLUMINATION ON HENS

INTERMITTENT LIGHT

ABRUPT CHANGE PEN 7

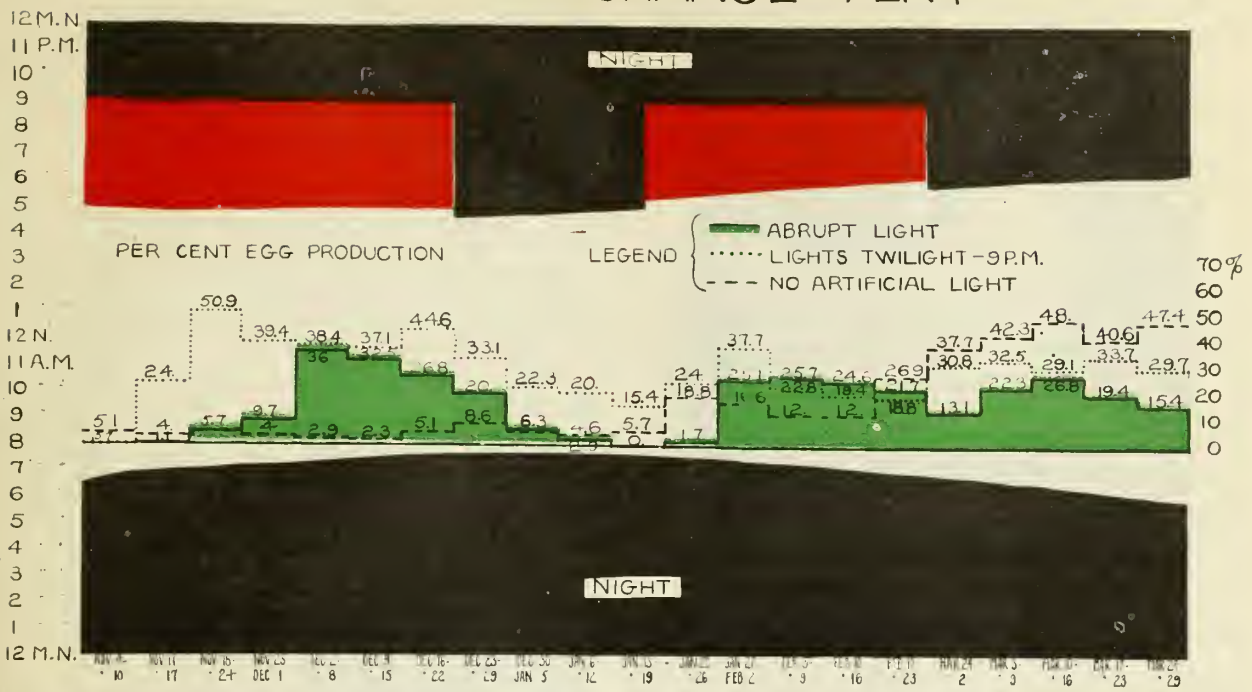


PLATE IX—Find description of this plate on page 16 herewith by Jas. E. Rice, Professor of Poultry Husbandry, New York State College of Agriculture, Cornell University, who was in personal charge of the experimental work which is illustrated so graphically by these ten color-plate charts. In connection with this chart, study Plate X below.

ILLUMINATION ON HENS

INTERMITTENT LIGHT

GRADUAL CHANGE PEN 8

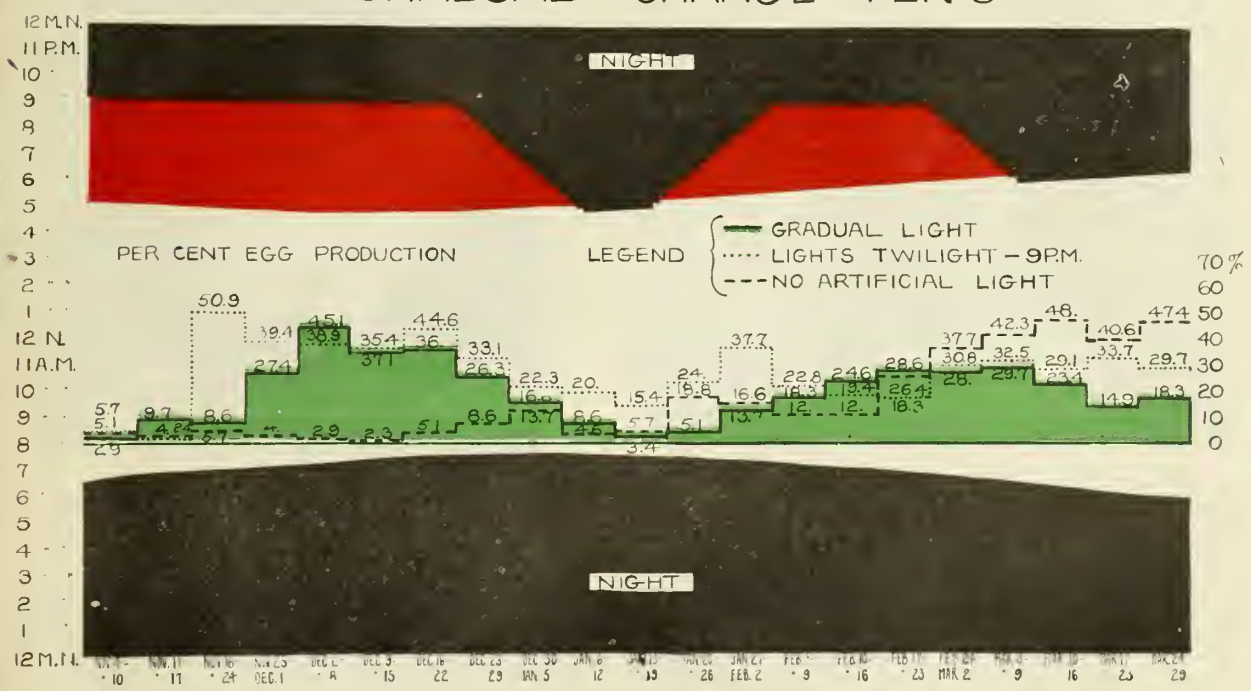


PLATE X—Find description of this plate on page 16 herewith by Jas. E. Rice, Professor of Poultry Husbandry, New York State College of Agriculture, Cornell University, who was in personal charge of the experimental work which is illustrated so graphically by these ten color-plate charts. In connection with this chart, study Plate IX above.

The increase in egg production with the hens under illumination was quite marked during the first four months and the last two months, as was also the decline in production from the normal check-pen flock not artificially

HEN No. A-5727, CORNELL UNIVERSITY

Laid 1,013 eggs from December 14, 1910-August 15, 1918, inclusive. Note length and depth of body.

lighted, as indicated by the open space between the dotted line and the green-colored portion of the chart in the sixth, seventh and eighth periods, which was from about the middle of April to the middle of July. The gains in production, therefore, were during periods of high egg prices and the losses in production on the part of the pens having illumination occurred during the periods of lowest prices. Essentially similar shifts in production from the low to the high priced areas, though less in degree, resulted with the pullets.

The most marked increase in egg production, due to artificial light, of any of the methods tried in this series of experiments was where illumination was given from 6 a. m. to daylight and again from twilight to 9 p. m., to a pen of pullets, thus giving at least a fifteen-hour day during the entire test. Under the same method of illumination the pen of hens produced about the same as in pen 25 (Plate V), where illumination was given only until 9 p. m., except that there was practically no decline in production during the summer. The consistently high egg yield during the entire experiment, except a slight drop during the 5th or 6th period, April and May, was striking, indicating that the hens were laying efficiently, which also means happily, throughout the year.

Rule That "Works Both Ways"

The real test of any theory or conclusion is whether or not the rule will work both ways which, being applied to illumination, means whether egg production can be increased or decreased AT WILL by the use of artificial light, all other conditions being essentially similar. Plates IX and X, page 15, show two brief tests that were made in the dead of winter" to find out to what extent alternately giving and withholding light would influence production favorably or otherwise.

In Plate IX, as is shown by the red portion, light was given to a flock of hens until December 16th, at which time the lights were discontinued until January 19th, a period of four weeks. The portion of the illustration in green shows that the production has been 36, 32, and 26 per cent respectively during the three preceding weeks and that during the next three weeks it declined until the fowls ceased laying. It also shows that during the second week following the turning on of the lights again that the production had raised to 25 per cent, but that notwithstanding the lengthening of the natural daylight period at this time, the hens did not reach even a normal production up to the date when the test was discontinued, the latter part of March.

Please refer to Plate IX. The line indicated by the dash shows the production of a flock of hens of similar quality under similar feeding and care that was not given artificial light. The dotted line indicates the production of a similar flock of hens which at the same time was receiving illumination until 9 p. m. continuously. While the production of this flock declined somewhat during the very severe weather, which prevailed at the time the test was made, they, nevertheless, maintained a yield of 33, 22, 20, 15, and 24 per cent production, while the flock whose light supply had been turned off, steadily declined and finally ceased to lay.

In order to observe the comparative effects between abruptly withholding the lights and abruptly turning them on again, as compared to diminishing and increasing them gradually, the test was made with a flock of hens similar in quality to those shown in Plate IX. In Plate X will be seen the influence of restricting the amount of light fifteen minutes each night until no lights were given and then continuing without lights for one week, then resuming the illumination gradually by increasing the amount of light fifteen minutes each day until the regular amount was given, namely—from twilight until 9 p. m.

The same flocks are used for comparison as in Plate IX, shown here also by the dash and the dotted lines. The green-shaded portion of the chart and the figures here given show that the production declined more gradually than in Plate IX, but did not cease entirely, though it reached an average of 3.4 per cent production for one week while no illumination was given and then gradually rose to 5, 13, 18, 26, 28, and 29 per cent respectively in direct conformity to the increase in the amount of illumination, fifteen minutes each day, until the normal amount of artificial light until nine o'clock was reached.

From the preliminary tests here reported one would not be justified in drawing final conclusions as to the most efficient methods of illumination. The breed of fowls, the laying quality of the stock, the condition of the birds, the climatic conditions, and methods of feeding —ALL these are important factors which, in other years, under similar conditions even in the same location, or in the same year in different locations, might produce different results. These tests, however, JUSTIFY THE

HEN No. A-7534, CORNELL UNIVERSITY

This hen laid exactly 1,000 eggs from November 16, 1910-September 20, 1917, thus entering the 1,000-egger class.

CONVICTION that artificial light was the factor CHIEFLY RESPONSIBLE for the increase or the decrease in production at various periods. This should lead us to the belief that the proper application of artificial light when it is correctly understood, IS LIKELY TO BE OUR MOST POSITIVE METHOD OF CONTROL OF EGG PRODUCTION. Respectfully,

JAS. E. RICE.

Ithaca, N. Y., November 18th, 1919.

Forcing Egg Yield By Use of Artificial Light

AN EFFORT TO REDUCE LABOR LED TO THE INTRODUCTION OF ELECTRIC LIGHT IN A POULTRY HOUSE AND THAT SUGGESTED LENGTHENING THE WORKING HOURS OF THE HENS BY TURNING ON THE LIGHT FOR AN HOUR BEFORE DAYLIGHT AND AFTER DARK—THE SURPRISING AND GRATIFYING RESULTS—THE EGG YIELD INCREASED AND NO ILL EFFECTS WERE NOTICED—THE AVERAGE DROPPED IN FOUR DAYS AFTER THE LIGHT WAS DISCONTINUED—THE EGGS HATCHED BETTER THAN THOSE FROM FOUR OTHER BREEDERS AND THE CHICKS WERE STRONG AND MORE VIGOROUS

By W. H. REYNOLDS, Braintree, Mass.

AS STATED to the editor of R. P. J. in a letter of recent date, I certainly have no objection to the public getting the benefit of what experiments I have made or may in the future make in the care and feeding of poultry, hence as promised, I give below a correct account of my experience.

April 20th, 1910, I purchased 120 day-old White Plymouth Rock chicks of Jos. Tolman, Norwell, Mass.; they grew well and from them I raised fifty-four pullets.

Late in September I put forty-seven of these in a new 10x16 Tolman open-front house. October 6th they

A view of the Tolman open-front poultry house that was lighted by electricity by W. H. Reynolds, Braintree, Mass. to try the experiment of lengthening the day for the hens in order to increase their egg yield.

laid their first egg and during the remainder of the month I received seventy-eight eggs. The first fourteen days in November they improved some and averaged fourteen per day.

This poultry keeping is but a hobby with me and wishing to eliminate as much of the labor as possible I had my houses wired for electric light, my idea being to care for them as much as possible after business hours, which, of course, during the short days meant after dark. The light in the Tolman house was so placed in the center that one forty watt tungsten lighted the interior perfectly.

As my egg yield had not increased as rapidly as I thought it should, I decided to try the experiment of feeding by electric light and in that way lengthen the working hours of the flock.

I started in by turning on the light just before dark and giving them a light feed of grain in the litter to keep them busy, later scattering the balance of their supper. Within a week I had them working and eating until 7 o'clock p. m. After they had become accustomed to this arrangement I continued to turn the light on before dark but did not feed until 5:30 or 6 o'clock.

At about 7 o'clock, to get them to go to roost, the light was dimmed with a dark cloth which would quickly start them for the perches and in a few minutes the light was turned off.

As I was obliged to feed early in the morning (6 o'clock) I would turn on the light and down they would come and go to work, thus gaining an hour in the morning during the short days. For the first week of the experiment there was an increase of but one egg per day, but the last eight days of November they averaged twenty-five. (Against an average of fourteen the first fourteen days of the month.—Ed.)

During the entire month of December they laid 1,028 eggs, 33 per day, or 70 per cent. The smallest number received any one day in December was 27; the highest was 42 once, but had 39 twice and 37 three times.

From January 1st to the 20th, inclusive, they have averaged thirty-one per day with a high score on January 2nd of 41, and on January 5th of 42; January 3rd and 9th 36 each. From January 20th to the end of the month they averaged but 20 with a score one day of fourteen, the lowest since November 19th.

I account for this falling off in yield in three ways: several had probably laid out their clutch, four being broody at one time, and about eight were afflicted with a touch of bronchitis caused either by an excessive amount of coal dust in the house from a dusting box which I had carelessly placed much too far from the open front and which was vigorously used by the hens, or if not from this cause then they may have taken a slight cold in some

A flash light photograph of White Plymouth Rock hens busily engaged in hunting in the litter for sprouted oats and dry grain at 7 p. m., the house being well lighted by electricity. For the result of this treatment on the egg yield, see accompanying article.

way, possibly from being allowed the use of an open yard in all kinds of weather.

Whatever the cause, it was not serious, for they all recovered promptly and from the appearance of the flock at the present time (February 1) I look for a rapid increase in the egg yield from now on.

From the time I received the first egg to the end of

January this pen has averaged 52 eggs per hen. The yield by months is as follows:

October	78	
November	509	Average per day 17
December	1028	Average per day 33
January	841	Average per day 27
Total	2456	

What effect this early unusual laying will have on the result for the year, I shall watch with much interest. While I may not get a larger yield for the year, I surely

A partial view of the nests, roosts and flock housed in an electrically-lighted Tolman open-front house by their owner, W. H. Reynolds, Braintree, Mass., who largely increased the egg yield of the flock during the coldest months of the winter by prolonging their day by artificial light.

have had a generous share of eggs when the price was the highest.

This remarkable egg yield for this season of the year is due almost entirely to the use of electric lights changing the length of the day for them to correspond with spring. The cold weather seemed to have no effect on the egg yield, in fact, some of the largest days were the coldest. My method of feeding varies but little from the regulation system.

How They Were Fed

I started in with hoppers filled with dry mash and meat scrap, but continued to feed sprouted oats which they have had from the time they were two weeks old. These oats, by the way, are a little different from what is usually meant by sprouted oats. I allow them to grow about five days when they will have a sprout from a half to an inch long; in this way I claim they not only get the benefit of the sprout, but much of the goodness is still left in the oat. In the morning I throw these into the litter and cover well. I soon found the more sprouted oats I fed, the less mash and scraps they ate until for the last two months they have eaten comparatively little mash or scrap. To this pen I feed about seven pounds of ground fresh bone per week. At night I feed a generous amount of mixed grain in the litter. In this way they have to work for practically all their food.

At the present time these hens seem strong and healthy and have much the appearance of yearlings. Have recently put three cockerels with this flock and shall have some of the eggs incubated in February and later in the season, expecting to get strong, lusty chicks, my theory being that these hens have not been forced, but by lengthening the day for them, they have had more hours to eat and assimilate food, conforming somewhat to the conditions of spring.

My other pen is made up of twenty-seven birds, twenty old hens and seven pullets culled from the other flock early in the season. In the case of these birds I cannot tell exactly how much benefit the light was, as I did not try it until about December 10th, and the house is poorly arranged for lighting, being cut up, which of course, makes shadows. By being persistent I finally got them to follow the same hours as the other pen with the result that they averaged but three the first 24 days in December; ten the last seven and 16 in January. From what I have been able to see, I feel confident that the old hens have done their share and done very well by comparison with what is expected of old hens at this time of the year.

I mention this as, in my opinion, the longer working day has had a tendency to shorten their rest period and had I started earlier in the season, I should without doubt have had much better results.

I have of course a daily record of the egg yield from these pens, but assume what figures I have given will be all that is necessary to show the benefits of the lighting system. If this system continues a success to the end of the season I shall have the lights made as near automatic as possible and also commence earlier in the fall, hoping by that means to mature my pullets earlier.

I enclose several photos of my flock—the two outside views were taken in the day time and give a fairly good idea of house and hens.

The interior views were taken between 6 and 7 P. M., January 29th, by flash light; these are not specially good, but are the best I could get by flash light and they give a little idea of the flock eating and working by artificial light.

Part of the flock of White Plymouth Rocks belonging to W. H Reynolds, Braintree, Mass., enjoying the outdoor air. They show no lack of vitality, though they had been forced for several months for greater egg production. See accompanying article.

Later News of the Flock

Braintree, Mass., March 8, 1911.

Editor R. P. J.:—

Yours of March 4th asking for further information about my experience in using artificial light in my poultry houses, received.

My previous letter gave the results to February 1st. February 14th my pen of 47 was reduced to 46, one becoming crop bound and not being noticed by me until it was too late to save her. During the month of February I received 551 eggs, an average of 20 per day, or 43 per cent, with a high record of 27 and a low one of 11.

During the month I reduced their working hours from 7 to 6:30 p. m. and on February 25th discontinued the lights as the days were then long enough to allow them to feed

(Continued on page 45)

Ten Eggs Per Week Per Hen and How It Was Done

THREE EXPERIMENTS WERE MADE IN THREE CONSECUTIVE YEARS, EXTENDING FROM DECEMBER FIRST TO APRIL FIRST — PRIMARY REASON FOR CONDUCTING EXPERIMENTS WAS NOT TO OBTAIN MORE EGGS FROM A GIVEN NUMBER OF HENS IN A SPECIFIED TIME, BUT TO SECURE EGGS OF HIGHEST HATCHING QUALITY — DESCRIPTION OF THE HOUSE, THE CARE AND THE FEED — NO PULLETS WERE USED — DAYLIGHT WAS ARTIFICIALLY PROLONGED AND NATURAL CLIMATIC CONDITIONS SECURED BY HOT WATER HEATING SYSTEM

By E. C. WALDORF, M. D., Buffalo, N. Y.

ACTING on your request to give the readers of your Journal the method and results of my forced egg production, I herewith present the plan from the data still preserved, together with facts as I recall them It might be well to state at the outset that the primary reason for attempting forced ovulation was not to obtain more eggs from a given number of hens in a specified time, but to secure eggs of the highest hatchable quality.

This suggestion developed from the fact that the eggs from hens laying five to seven eggs per week hatched much better than did eggs from the same hens when they were laying fewer eggs per week. Close observations along these lines were made for two seasons. It was also observed in connection with these experiments that only the dense eggs hatched in high percentage and that the density of the eggs was not lessened during the time of increased egg production. With these facts established, I began my first attempt in forced egg production in December, 1889.

E. C. WALDORF, M. D.
BUFFALO, N. Y.

So far as R. P. J.'s records show, after extensive inquiry, the credit belongs to Dr. Waldorf for being the first man in the United States—perhaps in the world—to employ, designedly and systematically, the use of artificial illumination for lengthening the short days of fall and winter, with the object of increasing the egg production of domestic fowls. He made his first experiments in the years 1889-1892 at his home on Porter Avenue, Buffalo, N. Y., where he still resides as a successful practicing physician. Farther on in this book are to be found interviews and reports from the pen of Dr. Waldorf, treating on this important — in fact, "revolutionary" subject in the field of constructive and progressive Poultry Culture" on profitable lines.

These experiments were made on the premises of Patrick Kinney, 56 York St., Buffalo, N. Y. A hen house for the purpose was erected, measuring 12 x 16 feet, inclining to the southwest and northeast. The height was 16 feet on the south side and 21 feet on the north. This gave a sloping roof to the south, which was glass, after the order of a green house roof. In the center of this glass roof was placed a ventilator shaft one foot square and three feet high. The top of this shaft was closed, having six one inch holes on each side near the top. Aside from the door entrance there were no other means of ventilation.

The entrance door was placed in the middle of the south end, leading into a hallway 3 feet wide, extending to the north end and as high as the skylight. This hallway was made of matched lumber, provided with four matched doors opening into each individual pen.

The house rested upon the ground, which was a sandy loam covered with fine gravel three inches deep. A trench eighteen inches wide and three feet deep was dug the full size of the house. This trench was covered with loose boards, sufficient to sustain banking but open enough to permit drainage, thereby ensuring against moisture in the ground floor of the house.

It may here be stated parenthetically, that several previous years' experience in poultry raising had taught me that success in any particular branch of the business was in direct proportion to attention to detail; therefore, in an attempt to realize the unusual, no important feature to that end should be omitted. To proceed, an excavation three feet wide, four feet long and three feet deep was made, bisecting the house from the east side to the west side. The excavation was lined with concrete, and in it was installed a hot water heating system with natural gas as fuel, which also was the illuminant for the house, which will be explained later.

The house was divided in three floors or sections from ground to roof, each subdivided as follows: ground sections seven feet high, each with a matched board ceiling. Six feet above this a similar matched ceiling was placed, leaving the top divisions, or third floor rooms or pens, three feet high on the south side and eight on the north. It will be recalled that the roof was of glass and it was here that most of the sunning and dusting was done, the floor being covered with dry dust and fine sand. Three inches of cut straw covered the sand and dust on this, the top floor. The second floor was covered with chaff and fine straw, to the depth of one foot. The ground floor was covered with oat straw one foot in depth, which was renewed once a month.

This house was provided with windows on all sides for the first and second stories, but high enough to prevent the fowls looking out from the floor. On the ground floor each sash was 18 inches wide, extending the full length of the pen and placed three feet above the ground. I might say in passing that some fowls become uneasy when they can look out, but are unable to get out. Therefore all windows were placed too high for the hens to see the outside ground from the floor. I had learned through previous experiments made with the same hens, that where the windows were close to the ground and there was no chance to get out, a loss of 30 to 50 per cent in egg production would result.

Wooden troughs one foot wide and six inches deep were constructed for each of the four lower pens and placed under the windows. The hot water heating system consisted of one inch pipes just above the windows on the ground floor and extending completely around the coop, returning to the heater along the floor of the

wooden troughs. The troughs were filled with fine dusting earth and wood ashes. Four small V-shaped troughs, one for each pen, 6½ ft. long, were placed in the partition and pivoted at the ends so as to appear in the aisle for filling and in the pen for feeding as desired. The troughs were suspended just high enough for feeding the daily mash. Two roosts, 5½ feet long, for each pen were placed 4 feet above the ground, above the feed troughs. The droppings boards were placed six inches below the roosts and nailed tight to the partition. A snugly fitted board six inches wide in the aisle partition, on hinges, facilitated cleaning the board from the aisle. Four automatic nests for each pen were placed eighteen inches above the roosts and made accessible from the aisle by hinged boards. Narrow doors for entrances at the corners where the aisles met completed the wood work, except the storm house 6x10 at the entrance, in which the feed was stored. The second and third floors were reached from openings cut in the floors at the ends.

I wish particular emphasis to be laid upon the tight board partitions, cutting off all view from any pen to another, as this arrangement is an essential factor to contentment. Nine hens and one rooster occupied each pen. They were locked in on December 1st and released April 1st, for three successive years. No pullets were used. The stock was purchased in the summer, indiscriminately, at the open Buffalo market for killing, only early molters being purchased. Both Mediterranean and Asiatic breeders were used, mixed or otherwise—size and health being the only requirements.

What They Were Fed

From this heterogeneous flock of one hundred fowls the selection was made, using the same hens in many instances for two winters. Feed consisted of cracked corn, oats, wheat and barley, each one-fourth. This grain was strewn liberally in the litter on the ground and second floors, after fowls were on the roosts, and then only. Moist, hot mash was fed daily at 10 A. M. The base of this mash was boiled barley and wheat, equal parts, in water which contained cut clover, cabbage and fresh beef bones cut in small pieces. This mixture was prepared daily and kept on the stove constantly and was boiled in a large copper kettle and used after twenty-four hours boiling and simmering.

Sufficient ground oats and middlings, half and half, were added to make just a moist mixture. Twice a week ground oyster shell and a tablespoonful of cayenne pepper were added to the mixture. Beef lungs were kept hanging within reach of the fowls at all times and were replaced with fresh when stale.

Six weeks were allowed for preparation, which was until January 15th.

In order to give the fowls natural climatic conditions the automatic thermostats were set as follows: Temperature of dusting boxes, 75 degrees; ground floor pen, 58 degrees; second floor, 65 degrees; third floor, 70 to 95 degrees, depending on sunlight for highest mark.

Prolonged Their Day Artificially

The proper length of daylight was provided by the installation of four, 100-candle power, Argand gas burners suspended from the first ceiling, one foot from the outside edge and five feet from the ground. Each burner was provided with a large reflector, throwing the light directly downward. These lights were controlled by an automatic time adjuster and were turned on at 3:30 A. M. and off again at 7:30. They were turned on again at 5 P. M. and off at 8 P. M. for the night. The results of these tests were published in The Clyde Times, Clyde, N. Y., in February, 1889, the complete daily record having since been mislaid or lost.

IT IS SUFFICIENT TO SAY THAT TEN EGGS PER HEN PER WEEK WAS THE AVERAGE FOR THREE MONTHS, AND VERY NEARLY SO FOR THE ENTIRE PERIOD, GRADUALLY FALLING OFF FOR THE NEXT TWO MONTHS AND THEN CEASING ALTOGETHER.

Any poultryman who will adhere to the general principles herein specified, in every small detail, can realize like results, and with well-bred, vigorous 1914-1915 laying stock no doubt could obtain twelve eggs per week per hen.

The remarkable activity and vigor of the hens was most surprising. The instant the clock mechanism turned up the lights, all would bound from the roost, and in two minutes they were digging for food in the litter like so many machines. Between four and five o'clock one-half the hens as a rule had laid and the others in the next two hours. In the same afternoon between four and six the majority would lay again, and so on, week in and week out.

Whenever the shells of the eggs from any hen were not firm and smooth, lime water was substituted for the regular drinking water until all eggs had firm shells. Solid cabbage heads were kept within reach of the hens, when loss in shell or loss of density was noticed. At this time the percentage of wheat to barley also was increased.

At that time there were no scientifically prepared feeds, as at present, and probably the use of the latter would enhance the results materially, besides lessening the close attention we gave to the feed. I might say in passing that there was not a single case of illness or death during the three seasons while this forced egg production was being carried on. On the contrary, there appeared to be complete happiness, with no evidence of a desire to get out doors at any time.

This fact is accounted for I think by the tight board partitions, the high windows and few number of fowls to each pen. I also consider the presence of the male a necessary adjunct to the flock to assure contentment of all. Another necessary factor is the same attendant in precisely the same clothes daily, dark blue being preferable. Also there should be no unnecessary noise, no pounding, no fluttering of paper, nor any motion which will cause the least fright or attention. No one but regular attendants should be allowed in the hen house at any time, and they ought not to enter the lower pen unless all fowls are above that floor. Talk gently to them at the time of feeding, etc. Clean chimneys and reflectors when fowls are on a floor above. Never add nor take away any fowl from any flock while engaged in an egg-test. Do this culling out in the fall and early winter.

With this attention to detail, ninety per cent of all eggs will pass the test for hatching and practically 100 per cent of such eggs are hatchable. I believe the system to be more profitable than the regular methods pursued. Fowls thus forced require fully one-third more feed than they would ordinarily consume. The important feature, however, lies in the fact that by it hatchable eggs can be obtained universally as early as desired. The writer distinctly recalls having set fifteen hens, each with fifteen eggs, in the month of January, and they hatched every egg.

The interesting tests here described would have been continued had not the fire underwriters objected to the use of gas in that manner. Electricity and the tungsten bulb offer today a far better light, with no risk, and such an illuminant is much to be preferred, not only on account of less risk, but also from an absence of dust in the burner itself.

(NOTE: The foregoing article is reprinted from the February, 1915, issue of R. P. J.)

Successful Use of Lighting in Back-Yard Plant

METHOD OF BACK-YARD POULTRY KEEPING THAT PAID WELL—FULL DETAILS ABOUT HANDLING MODERATE SIZED FLOCK IN CITY DOORYARD—OWNER USES INEXPENSIVE ELECTRIC LIGHTS TO PROLONG THE DAY AND STARTS A NEW FLOCK EACH SPRING BY BUYING DAY-OLD CHICKS — HIS NET PROFIT FROM A BACK-YARD FLOCK FOR ONE MONTH (NOVEMBER, 1917) WAS $87.29 — HOW HE MANAGES AND FEEDS HIS BIRDS

By WARREN V. CLARKE, Buffalo, N. Y.

WITH the hope that the story of my successful operation of a chicken "farm" in a space 25x90 feet, located at the rear of my city home, will be of benefit to those already engaged in a like venture and inspire others to go into the poultry business, I am submitting the following facts:

Eight years ago I began keeping chickens and during that time have bred Parks' Barred Rocks and Martin's White Wyandottes, also Black Minorcas and Rhode Island Reds, and for the last four years S. C. White Leghorns. I have never done any hatching, but always buy day-old chicks. These are brooded in a Prairie State hover supplied with a coal stove, but I use natural gas in place of coal. I have brooded from 50 to 514 chicks in separate lots at different times. My brooder house is divided into two compartments and the brooder room is kept darkened.

Feeding the Young Chicks

The first drink the baby chicks have is sour or buttermilk, and their first food is Pratt's and H. O. Chick Food, or two parts of crushed wheat and one part of pinhead oatmeal. I use rolled oats sparingly.

The chicks when ten days or two weeks old are given a dry mash, consisting of 50 pounds of bran, 25 pounds of middlings, 25 pounds of hominy or corn meal, 25 pounds of rolled oats, 10 pounds of meat scrap, sifted to remove the larger pieces, 10 pounds of bone meal, 5 pounds of charcoal and 1 pound of salt to each 100 pounds of mash.

Sprouted oats should be fed to the chicks when they are three days old. Sprouted oats is the chief green food of my chicks. It makes bone and keeps them busy, in fact, all my chickens from the time they are three days old receive a liberal supply of sprouted oats, and I never have any trouble with crop bound birds.

Interior view of a back-yard poultry house that has proved satisfactory. A few alterations have been made which are described herewith by the owner, Mr. W. V. Clarke. Note the electric light suspended from the ceiling. Mr. Clarke turns this light on in winter at 5:30 a. m. and switches it off for the night at 7:15 to 7:30 p. m. Electric light is not used during the day when the daylight is sufficient to keep the hens at work. For a full description of his successful back-yard poultry plant, see the accompanying article.

Feeding Sprouted Oats to Chicks

These sprouted oats are fed when the sprouts are one-half to one inch long. It takes the oats from four to five days to grow such sprouts, and when fed at this stage they are more like the tender weed sprouts that chickens seek in the spring and early summer. These oats are not allowed to grow sufficiently to be matted when fed. The feeding of large quantities of oats is recommended. I use them liberally in the mash and in the form of sprouted oats.

The chicks get rolled oats when they are young and crushed oats after they are ten weeks old. Oats and bran help to build up the frame of the chicks. As chickens do not care for middlings they are used only when the chicks are young in order to counteract looseness of the bowels. My chickens eat more grain than mash, and yet, as my records show, I GET THE EGGS. The droppings tipped with white show that the ration agrees with them. I do not feed too heavily of meat or fish scrap when the chicks are young because it upsets their digestive organs.

The ideal mash hopper, circular in shape, with 2-inch wire mesh on top of the mash, is absolutely non-wasting. Twelve birds can eat mash at one time. It is hung from a hook so that it is rat proof and it can be easily moved. Experience has shown that the chickens eat more mash when it is fresh every day, so I make a practice of adding a little mash every night and mixing it with the mash that is left in the hopper. If a week's supply of mash is put in the hopper the birds will eat more the first part of the week and less in the latter part, but by freshening it each day and stirring it up they consume a practically uniform quantity day after day.

Value of Automatic Feeding Hoppers

The automatic Ideal grain feeders I regulate so that they feed little grain at a time. This gives the chickens the exercise they need with a smaller floor space. I made a little change in the construction of this feeder so that it has both a rotary and a pendulum action, and by the

use of half a dozen washers I adjusted the feeder so that it gives out only a few grains at a time and it is easily operated by a young bird. The prolific busy layer obtains the feed it needs to lay eggs and the drone does not waste the food that it does if it is thrown in the litter. The pullets are started with the feeders when they are eight weeks old. On a cold night if I find that the chickens have not worked the feeders enough to give them the needed supply of food, I throw them a little grain that they can pick up quickly.

I have also found that it is well to be sparing with the litter, changing it as soon as it becomes heavy, for the fresh, light litter is warmer for the chickens and induces the needed exercise in cold weather.

When the pullets are five months old I begin to feed for eggs, giving them a wet mash and increasing the meat scrap and corn meal in their ration. By feeding in the manner described my birds have grown large frames and then can add the surplus of fat which is needed by a heavy-laying pullet.

Importance of Culling the Chicks

The importance of culling should not be overlooked. When the chicks are four weeks old I begin removing culls from the flock, that is, the undersized, weak chicks. If these culls are placed in a separate pen they will produce a small percentage of laying hens. It has been my experience that if there is any sickness it usually develops in the cull chick.

As an example of what can be done with culls I will cite the case of a friend, who, inspired by the success of my back-yard poultry "farm," wished to begin a similar enterprise. I suggested that he take the culls that I was about to kill and practice on them to learn whether he really liked chickens well enough to give them the necessary care to insure success. He fed them sour milk mash and of course gave them extra good attention, the result being that only one died, 19 were sold as broilers, and the pullets at the time of writing this, December, 1917, are laying.

My flock is culled when four, six, eight weeks old—in fact, they are culled constantly. Finally, when I pen the pullets in the fall the best are put in one pen and the poorer ones in another.

In culling for drones after the birds have reached the laying age, look for those that are yellow around the vent. When the skin has been pinkish and begins to get yellow, you can rest assured that the bird has ceased to lay or is about to stop laying. Another way is to pick the birds from the roosts that have small crops. Put these birds into a separate compartment and examine them. You will find a large per cent of them will be yellow around the vent.

The Back-Yard Poultry House

In our back yard are two poultry houses both 18 feet deep. The newer one is 18 feet wide and is divided in two pens, each 9 feet wide. The roosting pen has an open space two feet high, covered with wire, running across the front of the pen. The scratching pen is all open front, except two feet from the bottom where it is boarded to keep out the "weather."

In the spring I plan to alter this house by dividing the roosts, putting three roosts in each pen. They will not be very high from the floor and about one foot below them will be a frame covered with one-inch mesh, as large as the space underneath the roosts. It will rest on 8 to 12-inch boards set on edge inclosing this space. By this arrangement the droppings will go through the netting, the birds can not scratch in the droppings, and in getting off the roosts will keep their feet much cleaner, and thus the eggs will not be soiled.

Then I plan to put a wire partition in front of the roosts reaching to the ceiling, and in this partition will be a three-foot door entering the roosting compartment. It will be opened at night on the last trip to the coop to allow the chickens to come out of the roosting room the first thing in the morning, or I may decide to put in an arrangemet something like a trap-nest so the chickens can come out from the roosting coop but can not enter until I open the large door in the evening. Thus the hens will be kept away from the roosts in the daytime and they will spend more time eating the material out of which to manufacture eggs.

Herewith is shown an interior view of the other coop, though some alterations have been made in this interior since the picture was taken. The high roosts and droppings boards have been removed and lower roosts with the wire covered frame to catch the droppings, have been installed. There is absolutely no foul odor in either coop, and when there comes a leisure day or a warm day in winter the wire frame is lifted off and the droppings shoveled out.

MR. W. V. CLARKE, BUFFALO, N. Y.

In the accompanying article Mr. Clarke describes his back-yard poultry plant and gives some interesting figures covering two years, showing that in spite of high prices of feed, poultry can be made to pay a good profit. Mr. Clarke now uses electric light in the early morning and late afternoon and evening, and after its introduction he noticed a marked increase in the number of eggs laid by his S. C. White Leghorns. For electric lighting Mr. Clarke uses the ordinary low-cost incandescent bulbs. The cost of electricity for one entire year (Nov. 1, 1916-Nov. 1, 1917) was only $6.95, while his profits for one month alone (November, 1917) were $87.29. His birds are attended to before he goes to business in the morning and after he returns at night.

Of the two coops the old one seems to be warmer, as the air rising from the birds, heats the center and gradually works its way to the front of the coop. In the new coop with the shed roof the heated air leaves the coop faster and the coop seems colder.

My holidays are usually spent traveling around the country visiting poultry plants and exchanging poultry experiences with their owners. On a trip last summer I saw on Bumford Farms a coop fashioned something like the one shown herewith. This coop was 16 feet wide and 24 feet deep. The superintendent of the poultry farm said that it was the best coop on the farm, that it was the cheapest, capacity considered, and that he received the largest egg yield from it.

Points on Poultry House Convenience

This coop was built on 2x8's rounded in front, and it can be moved by a team like a stone boat. On my poultry plant, which I expect to have in the future, all

my coops will be moved every year, which will do away with soil contamination. The front of the coop will be altered, however, and I will use an overhanging front with windows below, hinged at the bottom so that on nice days there will be a front opening of 4x9 feet and on stormy or windy days the windows can be closed to keep out the snow and wind.

Having the roosting pens separated from the rest of the house, as described above, I can cull my birds easily by placing crates in front of the opening and examining the birds the first thing in the morning. In fact, I will have the birds under my control at all times. On my poultry plant of the future I shall provide yards so that different pens can be turned out into them, and later when the corn which I plan to grow around the houses, is old enough, the different pens will be allowed to cultivate it free of charge.

It is now well known that chickens need a liberal and constant supply of fresh water if they are to produce a maximum quantity of eggs. Of course it is quite a problem to keep the water from freezing in winter. I am installing the Little Putnam Stove (manufactured by I. Putnam, Box 1206, Elmira, N. Y.) using three in one coop containing 120 birds, and two in the other coop containing 70 birds. Each stove will heat or keep warm 2 gallons of water. It will keep it from freezing and yet as the water becomes low in the two gallon fount it does not get so warm that the chickens will refuse to drink it. The accompanying cut shows how I will arrange this water heater. A little way down from the top about on a level with the bottom of the top cross piece on the door, I have put a shelf on which I have the eggs placed as they are gathered during the day. This will keep them from freezing and they can all be carried into the house on the last trip at night.

Using Electric Lights

The "secret" of the heavy winter egg yield that I obtain is THE USE OF ELECTRIC LIGHTS night and morning, thus giving the chickens a longer day in which to consume food. I find that you can feed them a less concentrated food by elongating the day. Of course, no success can be attained unless the fowls are given reasonable care, the proper kind and quantity of food, plenty of drinking water and suitable quarters. These conditions would insure the health of the fowls. It is, of course, highly desirable that the birds you keep should have been bred for egg production.

The lights are turned on at 5:30 a. m. and switched off at 7:15 to 7:30 p. m. Of course, as soon as the daylight is strong enough they are switched off until three or four in the afternoon, depending on the brightness of the day. The lights are used from October 1st to April 1st with pullets, but with yearlings or breeders they are used from August to February 1st, the hens being rested during February and March so the eggs will hatch well during the rest of the spring and early summer.

Another advantage in using electric lights is that the chickens can be attended to after supper for the following day. The grain feeders and mash hoppers can be filled, likewise the non-freezing water founts. The only labor, which is a pleasant task, is gathering the eggs. As stated above, these are placed in the compartment built above the water fount and the eggs can then be counted and brought to the house in one trip. Once more let me call your attention to the fact that since I did away with the droppings board and installed wire screen, I have gathered day after day seven to eight dozen eggs and only two or three of them would need cleaning.

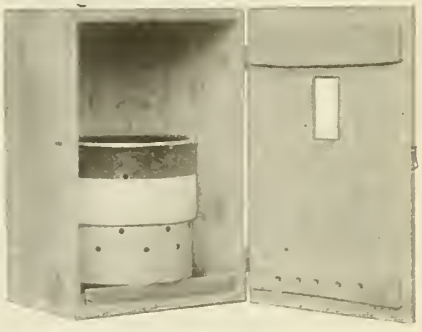
The objection may be raised that everyone cannot obtain electric lights. Most "back-yard" poultrymen can get this service, even in small villages, but when I move to my poultry farm I shall install a storage system if I cannot obtain current from a nearby electric plant. However, I shall seek a farm near a large city, as I consider 30 acres near a city, so that one may commute or drive to town each day, better than 60 acres where one would have to ship his products by express or consign them to a commission man, thereby losing at least 15 per cent of the producer's legitimate profits.

A Summary of Results

On request, I have gone into details regarding my little back-yard plant and the care I give my chickens, in the hope that the recital will benefit other "back yarders" who are not now meeting with success, and encourage others to go into the poultry business. I have pointed out the way and now I come to the pleasant task of telling the excellent returns I have had from my chickens.

First, we will consider the year extending from November 1, 1915, to Nov. 1, 1916. Of necessity, I will have to show the cost of bringing my flock to the point of earning power. April 18, 1915, I bought 104 day-old S. C. White Leghorns at a cost of $12. On May 23rd I bought 108 more of the same age and breed at a cost of $10.00. Out of the two lots I lost 18 chicks, leaving 194. In June, July and August, 1915, 90 broilers were sold at an average price of 44 cents, or a total of $39.60. In September 10 pullets were sold for $8.50, and 13 dozen eggs were sold in August, September and October at 35 cents per dozen, or a total of $4.55.

Buying my feed in small lots, it cost $64.30 up to November 1st. Deducting my receipts from my expenses left me a net expense of $33.65 and 94 chickens to start operations on November 1st. On taking inventory, I found I had 78 laying pullets to put into the laying house. There were 16 culls which I later sold for $11.53, which amount I included in my inventory for the year November 1, 1915, to November 1, 1916.



Patented June 13, 1916

ONE "BEST WAY" TO USE THE LITTLE PUTNAM STOVE

Mr. W. V. Clarke, in the accompanying article, states that he is now using five of these little stoves to keep the drinking water from freezing. He is utilizing it still further by placing a shelf inside the box on a level with the bottom of the upper cross-piece on the door. On this shelf he places the eggs as they are taken from the nests in cold weather. The gentle heat keeps them from freezing and then they are all counted and carried to the house on the last trip to the coops. Using electric lights and thus prolonging the day, Mr. Clarke frequently gathers eggs that are laid as late as seven o'clock in the evening. Following are the directions for using the Little Putnam Stove for this purpose as given by the manufacturer, Mr. I. Putnam, Route 1206, Elmira, New York:

"Take a box at least ten inches wide, ten inches deep and seventeen inches long. Remove the cover and make a door of it. Cut a hole in the door two by four inches. The bottom of the hole should be the same height as the top of the water container. Bore three or four holes, an inch in diameter, in the bottom of the door to admit air. They should be about two inches above the bottom of the door. The five holes (¾-inch in diameter) shown in the cut are in the correct position. Put an inch of sawdust or bran in the bottom of the case, and nail a strip, an inch square, across the front to keep it in. The above arrangement keeps the flame from being blown out, and the water from pollution. In hot weather this case may be used without the stove to keep the water cool and clean. Fowls frequently freeze their wattles in winter by getting them wet while drinking. To prevent this fill your water vessel full of clean straw and pour the water in on the straw. The fowls will poke in the straw to get what water they want, but the straw will keep their wattles out of the water."

A strict account was kept of the cost of feed, etc., as well as sales of eggs and chickens for food. The net profit per month was as follows:

November, 1915	$ 5.14
December, 1915	31.66
January, 1916	33.11
February, 1916	24.80
March, 1916	25.98
April, 1916	18.08
May, 1916	24.60
June, 1916	21.85
July, 1916	27.37
August, 1916	29.41
September, 1916	19.80
October, 1916	14.02
	$275.82

Deducting from this the $33.65, net expense, November 1, 1915, mentioned above, left me a net profit of $242.17.

Every month the non-layers were culled and disposed of at 20 cents per pound, so that November 1, 1916, I had only 20 out of the original 78 pullets left and these were October molters that were still giving an average of four eggs daily. The monthly egg yield was as follows:

November, 1915	388
December, 1915	778
January, 1916	1026
February, 1916	1022
March, 1916	1369
April, 1916	1403
May, 1916	1486
June, 1916	1313
July, 1916	1194
August, 1916	706
September, 1916	605
October, 1916	290
	11,580

From February 1st to August 1st the number of pullets varied from 72 to 63.

The sale of the culls, non-layers, reduced the feeding cost and did not affect the egg production to an appreciable extent. The average monthly cost for each chicken proved to be 13 cents. This included litter.

Used Electric Lights the Following Year

November 1, 1916, I had 87 pullets and 21 yearlings, which were gradually reduced until November 1, 1917, I had 19 yearlings left, October molters.

Electric lights were used during this year and a careful account kept of all expenditures. My net profit per month was as follows:

November, 1916	$44.55
December, 1916	80.72
January, 1917	61.76
February, 1917	41.99
March, 1917	42.12
April, 1917	11.41
May, 1917	32.40
June, 1917	32.50
July, 1917	36.86
August, 1917	14.29
September, 1917	46.36
October, 1917	2.52
	$447.48

During this time the electric lights cost me $6.95. The egg yield by months was as follows:

November, 1916	1464
December, 1916	2070
January, 1917	1830
February, 1917	1335
March, 1917	1449
April, 1917	1281
May, 1917	1145
June, 1917	1327
July, 1917	1332
August, 1917	864
September, 1917	329
October, 1917	115
	14,541

April, 1917, I bought 514 day-old chicks which cost me $107.67, including the expressage. I lost about ten per cent and of the remainder 50 per cent were pullets and 50 per cent cockerels. About two-thirds of the pullets were good to keep and one-third was sold. The day-old chicks I bought for the year, November 1, 1917, to November 1, 1918, came from three different poultry farms and were hatched April 23rd. In my best pen the first egg was laid October 4th and in my second pen October 24th, and I received altogether in October 316 eggs.

From April 23rd to June 1st my expense, including feed, gas and incidentals, was $42.13 and for June $48.74. July showed a credit of $27.64 on account of the sale of broilers. Expenses for August were $34.30. September showed a profit of $8.94, credit being given for the sale of a few third-class pullets. In October the expenses were $37.03, making 168 pullets left cost $234.29 or about $1.40 apiece.

The egg yield for November, 1917, from 168 pullets and 19 yearlings, October molters, was 2781 eggs, which sold for $152.40. The expenses for feed, cartons, electric lights, extra labor and incidentals were $65.13, leaving a net profit of $87.29 from 187 chickens. Again I repeat that I credit the electric lights with this unusual profit.

The reader will note that as eggs go up in the fall my egg yield increases, and the yield drops off when the price goes down. The use of electric lights reverses the seasons so that in November and December my flock nets me as much as many a plant of a similar size does in a whole year.

So far this winter I have been receiving from 61 cents to 80 cents a dozen for eggs at wholesale and retail. A special customer who wants the over-sized eggs pays 80 cents a dozen for them. One of the highest class groceries is glad to take all the eggs that I can furnish and they have paid me from 61 cents to 68 cents a dozen for them. When they paid 68 cents they sold them for 80 cents, and they had a greater demand for them at that price than I could supply. At the time this article was written I charged 70 cents retail to persons who called at the house for eggs. I might add that the eggs are quite uniform in size and there are not many cull eggs to be used at home.

After the November and December laying is finished and the egg yield decreases, watch for the drones and sell them off. Every chicken you sell now saves 27 cents a month for feed.

Do not sell the birds that molt in May for you will receive eggs from them in June, July and August when other hens have ceased laying and prices go up again. Sell the July, August and September molters and keep for breeding stock the birds that have laid from October to October without molting.

Of course everyone has a dream of the future, and mine is to go out on a small farm near a large city where I can retain my present business connections except for perhaps three months in the summer. By using a small truck going to and from my home I shall be able to take to market what I have to sell and haul out what I wish to transport to my farm.

This farm will produce hay in addition to poultry and eggs because of all crops hay will stand the most chicken manure. Grass needs nitrogen, especially timothy, so I would put the droppings on three or four acres and gradually increase the pasture until it embraced half my farm acreage. There is little extra labor needed for a hay crop in the spring when one's whole attention is needed in incubating and brooding chicks. One can always get a hay crop harvested on shares and when you have to plow up your rich pasture land you will find the ground in splendid condition for a crop of corn.

This idea of a combination hay and poultry farm was suggested to me by a poultry farm I ran across near Dorset, Vt. It has a gravel soil with springs forming little streams running down the mountain sides and through the flat meadow. Ten years ago this farm was in a run-down condition, but last summer when paying a visit there I found them cutting and storing, instead of the scant ton per acre which used to be the yield ten years ago, two tons per acre. The increase was due to the practice of putting the poultry droppings on the pasture.

At present it would not pay me to keep breeders and incubate eggs, but on a large poultry farm this would be the natural thing.

Like others I have read Uncle Sam's appeal for a greatly increased production of poultry and eggs this spring and summer. I hope that the writing of this article will give many persons the courage to invest in one or two hundred day-old chicks, for by following my method, adapting it to the conditions they must meet, I am sure they can aid materially in increasing the production of eggs, while in spite of the high prices that prevail for poultry feeds, they can make an excellent profit, have all the eggs and poultry they need for their own use and have enough to sell to show a good profit, and this can all be done on a small back lot with a small investment for equipment.

(NOTE: The foregoing article is reprinted from the February, 1918, issue of R. P. J.)

"Lighting System" For Increasing Egg Production

TO BE USED AS A MATTER OF COURSE, DURING THE "DARK DAYS" OF FALL AND WINTER—HENS ARE EGG-MACHINES—THEY NEED "TIME" AS WELL AS MATERIALS FOR ADDING TO THEIR OUTPUT — ARE NOT LIMITED NOR CONTROLLED BY MAN'S CALENDAR — AN INEXPENSIVE PLAN THAT NEXT FALL AND WINTER SHOULD BE PUT TO THE TEST BY THOUSANDS OF AMERICAN POULTRY KEEPERS

By J. B. ROE, Pasadena, Calif., and E. C. WALDORF, M. D., Buffalo, N. Y.

WE regard the following interview as being one of the most important that R. P. J. has ever presented to its readers. No poultry keeper who sees this report should pass it by without getting the full value of its message. All are well aware that fresh eggs marketed for table use bring the highest prices in the fall and winter of each season, because of the fact that at this time they ARE SCARCE—that but few are laid in the short, cold days when fowls are comparatively inactive.

Dr. E. C. Waldorf, Buffalo, N. Y., demonstrated back in 1889-1892, that by lengthening the feeding and digestive day of the ordinary hen, she can readily be induced to average more than one egg per day, extending over a considerable period, and now a California Barred Rock breeder has stumbled on the fact that by lengthening the short, dark days of the fall and winter months he enabled his hens to double and treble their egg yield during this season of scarcity and high prices.

And the plan employed by him and by his poultry-keeping neighbors is inexpensive and easy of adoption, decidedly so. Extensive egg plants on the Pacific Coast followed his lead and now report equally favorable results on a large scale. Next fall and winter literally hundreds of thousands of other poultry keepers throughout the land should adopt this low-cost plan and put it to the test, in their own interests.—Editor.

AS STATED in September, 1919, issue of R. P. J., page 117, Mr. J. B. Roe, Pasadena, California, breeder of Barred Rocks, visited R. P. J. offices while on an extended eastern trip in quest of Bronze Turkeys. Part of our interview with Mr. Roe was of such vital and timely interest to Poultry Culture in this country, especially as regards fall and winter egg production, that we had a stenographer take down his statements, which were substantially as follows:

"I put in, in 1915, what I now call the 'lighting system.' My reason was that in showing birds on dark days or in the evening to prospective customers, I like to take them right from the roosts and with the houses lighted I could do this. My roosts are three feet from the ground. I put in twenty-five candle power National Mazda lights, one to every twelve feet.

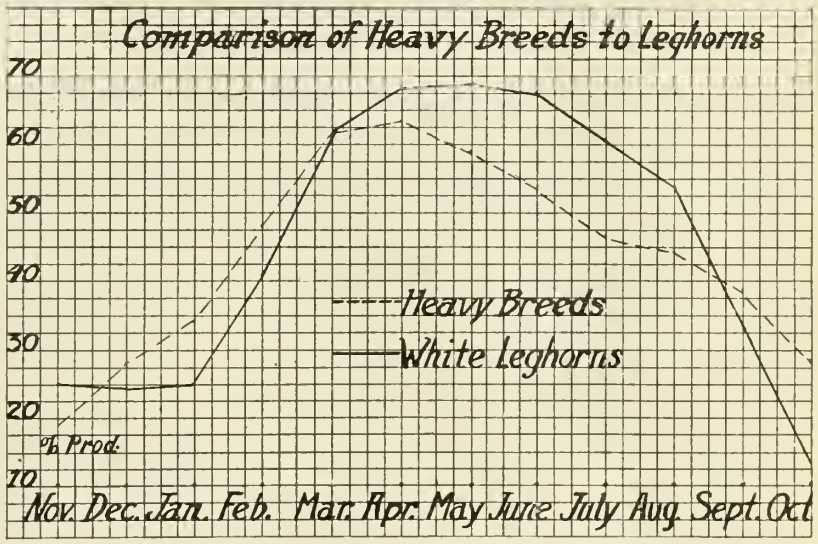
"For flock matings for egg production, I have two long, continuous houses, each one hundred feet long by sixteen feet wide. These houses are divided by partitions into four sections and each section into two apartments. In the center of each 12x16 foot space, I have a light. I keep about fifty birds to every twelve foot space, but this number depends on the birds I have and what use I am making of them. There are no separate scratch sheds. Sometimes for every twelve feet I have seventy-five or more birds.

"The window in each twelve foot space is about 8x4 feet. I have yards in front of these houses, leading out one hundred feet—every yard having three orange trees in it. Under the second tree from the house there is a water fountain, with a continuous drip, and I also keep water in the house. In front of these yards, opening out of them is an alfalfa field, into which the fowls are turned to get green food.

"Under my plan a house one hundred feet long has a capacity of four to six hundred layers. At present I have about three hundred fowls to the house and as soon as the mating season is over I shall take the males out and put them by themselves, so that the eggs for market will have no germs. All special matings are trap-nested during the breeding season. I have thirteen special mating yards, besides the two large houses.

How "Lighting System" is Operated

"In the two long laying houses, before described, I turn on the the twenty-five candle power electric lights at 4:30 in the morning, when it is not day-light at that hour, that is, during the fall and winter. The fowls get down immediately and go to scratching in the litter for grain left over from the night before. This keeps them warm and they do not get cold. They do not get enough feed in this way early in the morning to fill up and later they go to the egg mash hoppers, which are kept filled. I



HOW WELL THE "GENERAL PURPOSE" BREEDS LAY THROUGHOUT THE YEAR, AS COMPARED WITH LEGHORNS

The data used in preparing this graph included weekly reports (annual production) of the Sixth Annual Storrs, Conn., Laying Contest, the First Vineland, N. J., Contest (year 1916-1917) and the Philadelphia North American Contest, Newark, Delaware. The original drawing and the data in regard to it, were set forth in a thesis by Markus A. Canfield, Jr., of the New Jersey Agricultural College, the subject of which was, "The Elaboration of Production Standards for Poultry." The term, "Heavy Breeds", as used on face of the graph, includes Plymouth Rocks, Wyandottes and Rhode Island Reds. The lines represent monthly percentages of production for a complete year, starting with 19.1 per cent for the heavy breeds in November, running up to 63.1 per cent in April and finishing with 28.7 per cent in October. The Leghorns started with 24.8 per cent in November, reached 69.3 per cent in May, and dropped to 12.8 per cent in Octoher. A study of this chart will readily show the reader what to expect in egg production, without the help of artificial light, throughout the production year, starting November 1st and ending October 31st following. It shows that the three general purpose breeds here mentioned laid somewhat more eggs November 15th to March 15th on the average; that these three breeds laid considerably fewer eggs March 15th to the folowing September 15th, and that they again excelled the Leghorns somewhat from Sept. 15th to Nov. 1st following.

feed green stuff at noon. Oats and barley are sown in the yards every week, the fowls eating them at will.

"Nothing more is fed until 6 o'clock each evening, which is my feeding time the year round. In the late afternoon the lights are turned on again, before the fowls start for the roosts and are left burning until 8 o'clock. The birds feed from 6 o'clock to about 7:30, which leaves them half an hour to get to their roosts before the lights are turned off at night. They get all they want to eat by the time they go to roost.

"The litter consists of mill shavings about four to five inches deep in each scratching apartment. In the front part of the house, enclosing a space about 8x12 feet, a twelve-inch board stands on edge to form a scratching pen. Board extends down the center of each section. The sun shines in here (Pasadena) in winter time and a curtain is provided to drop down for shade in summer.

"Scratch feed only is put in the litter. I use millet, maize, Egyptian corn and Kafir corn. In the winter season we use Indian corn. The fowls fill up every morning on grain left in the litter over night, before they go to the laying mash in hoppers.

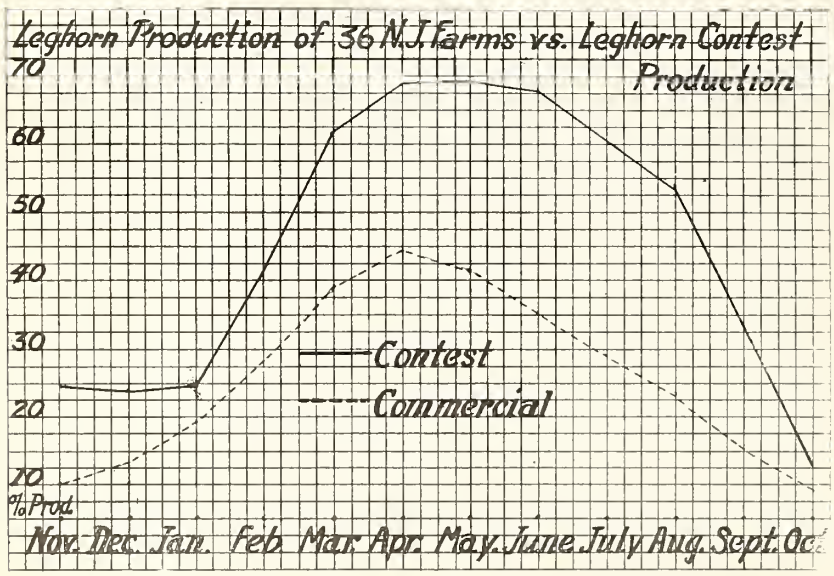
"MY PERSONAL EXPERIENCE HAS DEMONSTRATED THAT THE EGG PRODUCTION CAN BE INCREASED IN FALL AND WINTER FULLY THREE HUNDRED PER CENT BY THE USE OF LIGHTS AS HERE DESCRIBED.

"Mr. and Mrs. E. B. Martin, Downey, Calif., breeders of S. C. White Leghorns, as a result of my experience, installed the lighting system last fall and Mr. Martin told me recently that their egg yield within ten days to three weeks increased from one and one-half cases to seven cases per week.

"E. E. Emerson, well-known poultry judge at Burbank, California, also a breeder of White Leghorns, carrying about 6,000 hens, put in his lighting system last November. His egg yield increased from about two cases to eight and ten cases within a short time.

"Messrs. Swanson and Johnson, San Gabriel, Calif., who carry between 10,000 and 12,000 S. C. White Leghorn hens, also put in the lighting system last fall and Mr. Swanson told me lately that whether it was this system or something else, their egg yield last fall and winter more than doubled soon after it was put in—in fact was nearly three times greater than the previous year.

"Getting down to actual practice and results, my view of the matter is this: it takes a healthy hen just about so long to convert a given amount of the right kinds of food material into a normal sized egg. In the fall and winter, if left to ordinary conditions, she has only eight and one-half to nine hours in which to do this, whereas by the lighting system, here described, I furnish her fifteen to fifteen and one-half hours. That, I believe, is the reason for the increased egg production where the lighting system is installed. Thus far it has proved successful in every case I know about, including the three examples I have just told you of.



AN R. P. J. GRAPH WHICH SHOWS "HOW NOT TO MAKE MONEY"

Probably that is a back-handed way of putting it, but the truth—the FACT is there. The lines in this graph represent the production, in percentages, of the 600 Leghorns in the first Vineland, N. J. (1916-1917) International Breeding and Laying Contest, contrasted with the production of the thirty-six commercial Leghorn plants for the same year in the same state—this data being secured from the New Jersey Survey Bulletin, No. 329, which bulletin has been reviewed at length in these pages, see the two articles in May and June 1919 issues, entitled, "Poultry Farming a Profitable Industry in New Jersey." The contest pens, it will be noted by this graph, started with 24.8 per cent production in November, reached 69.3 per cent in May, and dropped to 12.8 per cent in October. Now, how about the meant-to-be money-making commercial plants in the Vineland egg farm district, so called? These thirty-six commercial farms secured a production of only 10 per cent in November, reached 44.2 per cent in April and dropped to 9.6 per cent in October. Perhaps New Jersey commercial farm men ought not feel overly downhearted, however, because an investigator of the subject recently stated, on what we believe to be good authority, "New Jersey has an average production of at least ten eggs per hen per year MORE than other states." Our point is that the wide area BETWEEN these two lines in the graph means MONEY—is simply that much "gold" that the commercial egg farm men of highly favored New Jersey (as to climate, soil, etc.) ARE NOT GETTING by the use of their present methods. This further emphasizes the value of egg-laying contests as a source of valuable and much needed facts and general information, obtained at public expense—from the tax payer's money—for the use of poultrymen who wish to make all they can from poultry and egg production, on the basis of private enterprise.

"I have this lighting system throughout both of the one hundred foot houses. It is not expensive. A twenty-five watt Mazda lamp will not consume as much 'juice' as a fifty watt ordinary incandescent lamp. When these Mazda lamps burn out, the average electric light company will replace them free of charge with the old style of light, providing the consumer will stand for it.

"I mix my own mash—that is, the egg mash. Out with us the Coulson egg mash is popularly used, and with Leghorns gives excellent results, but I have one of my own that is especially suitable for Barred Rocks. For the Rocks we add more wheat bran to the mash and use less meat products. Our idea is to fill them up, but not get them too fat.

"I feed grain rather sparingly and make my Barred Rocks scratch in the litter for every particle of it. At night is the only time they get all the grain they want to eat, but they have already filled up on egg mash. In the morning they are ready to jump right into the litter again after the grain that is left from the night before. If they were to get all the grain they wanted in the morning, they would stand around, but after getting a little grain they go to the mash hoppers. The exercise and shavings keep them warm and they never have colds. The houses are open in the front all the time—the whole front being boarded up about three feet from the bottom."

The Hen As An Egg Machine

The results above reported are based on the theory, on the FACT that the domestic hen is an egg-machine; also on the fact that her ability to manufacture eggs is not regulated by the calendar, nor by

(Continued on page 45)

More Evidence of Egg-Yield Value of Lighting System

ONE COMMERCIAL EGG PLANT INTRODUCED ARTIFICIAL LIGHTS IN LAYING HOUSE AND AVERAGE EGG YIELD CLIMBED FROM 154 TO 194 EGGS IN TWO SEASONS — IN ANOTHER PLANT WHERE LIGHTS WERE INSTALLED EGG PRODUCTION SOON ROSE FROM 12 TO 80 PER CENT — FIRST PLANT GIVES CREDIT ALSO TO BREEDING FROM HIGH PRODUCERS — BOTH AGREE LIGHTS CAUSE MAXIMUM EGG YIELD IN MONTHS WHEN PRICES OF MARKET EGGS ARE HIGHEST — BIG HELP TO COMMERCIAL PLANTS

By MESSRS. M. E. ATKINSON, Hollywood, Wash., and E. E. EMERSON, Burbank, Calif.

HAVING heard that Mr. M. E. Atkinson, manager of the Poultry Department of Hollywood Farm, Hollywood, Washington, had been using electric lights in his poultry houses and that as a result he had established what may be a world record for a commercial flock numbering thousands of birds—in this case about 6,000—which last year laid an average of 194 eggs per hen, we asked him for particulars. By use of the "lighting system" a much larger proportion of these eggs than usual were laid in the high-price months of November, December and January.

Mr. Atkinson replied as follows:

"In answer to your letter of recent date will say that we have used electric lights in the houses containing pullets since January, 1916. We start our fiscal year September 1st. Last year our pullet flock of 6,000 birds averaged 194 eggs. The previous year when we used the lights in January, February, also a part of March, they averaged 179 eggs. The year before when no lights were used, the average was 154 eggs. This year we have 6,700 pullets and we believe they will average over 200 eggs. However, we give our breeders more credit for the increase than we do the lights, because each year our trap-nest records are better and consequently we have had more high producers to use in the breeding pens.

"We believe that if we can persuade market poultrymen to use males from high producing hens it will do the poultry industry more good than any other one thing.

"Just what credit for the increased egg production we should give the artificial lights in the poultry house, we are unprepared to say because since using lights we have never kept a pen of pullets without the lights, as a check pen, but we can compare our records with records made by our birds at egg laying contests where, we understand, no lights were used.

"For instance, we entered a pen at Mountain Grove, Mo., in the 1915-1916 Contest, which laid 1101 eggs, an average of 220.2 eggs. One individual in the pen laid 275 eggs and another 262 marketable eggs.

"At the Philadelphia North American Contest at Newark, Del., November 1, 1916-October 31, 1917, our pen of five birds laid 1,166 eggs, an average of 233.2. One pullet laid 265 eggs, another 252, and still another 251. As stated above, it is our understanding that no lights were used there.

"We have many hens with better twelve months' records than these. There is one that laid 307 eggs, another 304 eggs and another 298 eggs last year, but we must remember that the eastern climate is colder in winter and warm in summer and that the contests run 365 days from a given date while at home we start the record with the first egg laid in a trap-nest.

Where Artificial Lights Score

"There is one important thing for which artificial lights must receive full credit, namely, that by their use we get the highest egg production in November, December and January. We produce more eggs in these three winter months than we do in any other three consecutive months of the year, and at that time market prices are the highest. By the use of lights, pullets give their maximum yield earlier and the spring yield is less than if no lights are used.

"Many of the pullets that are kept under lights molt in the spring, but the better they are bred, the less they molt. Am enclosing copies of pen records that we keep where the pullets are not trap-nested. Only 900 are trap-nested each year. We take a few from each mating each hatch and trap-nest them in order to keep a check on our matings and to give us the highest producers from which to breed our males.

"We brood each season about 16,000 chicks and sell all the stock when they commence to molt in the fall except the cream, which birds are kept for breeders for ourselves or for sale as breeders.

"Pen 5, whose record I am sending you, is one of our four best pens, while Pen 6 is one of our two lowest. Notice, please, the date they were hatched, the date they were moved to the laying houses and that both were first choice

"By 'first choice' we mean this: We rear all our chicks in room brooders, the rooms being 14x40 feet—about 1,000 chicks to a room. The cockerels are removed at an early age and the pullets are left in the house to mature. When they are in a fair lay,

TARTED EARLY IN ERIE COUNTY, NEW YORK

IN an article by R. S. Moseley, East Aurora, Erie Co., N. Y., at that time Extension Instructor and Field Project Supervisor, Department of Poultry Husbandry, New York State College of Agriculture, Cornell University, Ithaca, N. Y., which was entitled, "The Cornell Poultry Project is a Real Success", occurred the following reference to the use of "artificial light to prolong the day."

"The use of lights in hen houses to lengthen the hens' working day has been adopted by practically all the members of the 'Project' in the county, and over 100 plants in the county, outside of the 'Project', are using lights at the present time. Electricity, natural gas, kerosene lamps, gasoline lanterns, and acetylene gas are all used. Two methods of operating the lights are used in the 'Project' at the present time—from 5:00 to 6:00 a. m. until daylight, and from dusk to 8:00 p. m.; also at night only, in which case lights are kept going until 9:00 p. m., depending upon each farmer's conditions. Under the first system hens are fed at a regular time in the morning and hard grain at 6:00 to 7:00 p. m. and under the latter system at 8:00 p. m. Dry mash is before them all day.

"The lights have the effect of giving the hens an April length of day and thus they have a chance to eat more than they naturally would and gain more exercise, which is like spring conditions.

"The 'Project' has been using lights for three winters and it has been a great help to poultrymen in getting high-priced eggs. Breeding birds are kept under lights only from February 20th in order to start them up so as to secure early hatching eggs. Many things enter into the successful management of flocks under lights which space does not permit me to mention. Cornell Experiment Station is working on the use of lights this year. The records from the 'Project' show that artificial light has increased winter production from 30 to 60 per cent over fowls kept under natural conditions."

we go through and select those that are laying, or about to begin laying and remove them to a laying house. These we call first choice. The backward ones then come on faster and when they are matured we make another selection. It is our aim to cull our flocks before they go to the laying houses, not afterward. Pen 6, you will note, never reached the degree of laying that No. 5 did. They were in a 50 per cent lay when they were moved and some of them started a partial molt early and as they came through, others started. It would be no surprise if they produce as much gross in dollars and cents at the end of the year as Pen 5. We do not expect any of our pens to drop below 55 per cent in egg production. After a partial rest in the spring when ordinary birds are laying the heaviest, our birds are ready to take

HOLLYWOOD FARM

Year—1917 POULTRY DEPT.
House—4. Pen—6.

Hatched—March 15th. Moved—September 11th.
Brooders—8. Choice—First.

Pen Cleaned.		Egg Production						
Date	Bales	Month	Day	High and Low	Birds	Total Eggs	Per Cent	Rema'ks
		August						
			30	211				
		September			305	3340	55.0	
			5	206				
		October	28	158	305	5701	60.3	
			27	214				
		November	3	172	305	6202	65.6	
			1	237				
		December	12	197	304	6723	71.1	
			2	225				
		January	28	141	305	5881	62.2	
			18	203				
		February	25	167	302	5167	61.1	
			30	193				
		March	17	144	299	5392	58.1	

HOLLYWOOD FARM

Year—1917 POULTRY DEPT.
House—4. Pen—5.

Hatched—April 5th. Moved—September 25th.
Brooders—11-14. Choice—First.

Pen Cleaned.		Egg Production						
Date	Bales	Month	Day	High and Low	Birds	Total Eggs	Per Cent	Rema'ks
		August						
			30	131				
		September			309	630	34.0	
			26	225				
		October	2	113	309	5776	60.3	
			11	244				
		November	9	195	309	6702	72.3	
			11	252				
		December	31	203	308	6951	72.8	
			3	244				
		January	24	208	305	6713	71.0	
			1	222				
		February	21	173	303	4929	65.5	
			22	201				
		March	5	151	303	5461	58.1	

up the good work when the others drop off, and so we catch the higher market again.

"We are not yet prepared to say that the use of artificial lights in the laying house will increase the number of eggs laid in twelve months, but the use of lights will certainly increase the earning power of each hen by causing her to lay in the seasons of the year when her eggs will bring the highest price.

"We turn the lights on at 5:00 A. M. and off at daylight, turning them on again at dusk and off at 7:00 P. M. We do not believe they should be used in the houses where the breeding stock is kept. The breeders should be permitted to rest during the winter in order to give the best results in strong, fertile eggs during the hatching season."

We are reproducing above the two cards sent us by Mr. Atkinson in order that our readers may see the data they have found it advisable to collect and a sample of the egg yield of their flocks in the winter months. Read also what Mr. E. E. Emerson has to say herewith about using artificial lights.

CALIFORNIA PLANT USES ARTIFICIAL LIGHTS WITH MARKED SUCCESS

By E. E. EMERSON, Burbank, California.

(NOTE—So far we have found, those who use electric or other bright lights in their hen houses are unanimous in declaring that it increases the winter egg yield; also they are agreed that lights should not be used in the pens where the breeding stock is kept. Following is more testimony in its favor, this time from a California breeder of S. C. White Leghorns, representing the firm of Emerson and Mumford, Burbank, California.—Editor.)

"IN REPLY to your inquiry regarding the lighting system as used in California poultry houses, will say that I am pleased to tell our experience to the readers of R. P. J., hoping that it will help them in these strenuous war times to solve the problem of profitable poultry keeping in spite of the high cost of feed.

"When the subject of installing an electric lighting system in the laying houses to increase the egg production was brought to my attention some years ago, I confess I was, as many others are, somewhat skeptical about its efficiency. One of the objections raised was that it would tend to overwork our 'egg machines', and many really thought they would not hold up in the year's production.

"It stands to reason that when a hen sits on a roost sixteen consecutive hours out of each twenty-four without food or water, there is much more danger of a lowered vitality from lack of exercise and the long hours without food than there is of their being overworked when they are aroused at an early hour. One of the strongest arguments in its favor is that the lights are turned on at the coldest hour in the morning and the hens immediately become active and avoid being chilled or standing huddled in the corner in the half light of the early morning.

"It was not until we put in a commercial plant in connection with the fancy that we really became interested and decided to install the system as an experiment in one section of the utility division of our plant. This laying house is 16 feet wide by 120 feet in length and is divided into six compartments, each 16x20 feet.

"One hundred pullets were placed in each division and we had a 50-watt Mazda light placed in each section in such a position that the mash bins were well lighted. In this house the bins are in front and the lights were placed in the center of the roof. They were turned on by the ringing of an alarm on a Big Ben clock.

"We began by getting the birds up a half hour earlier than usual and gradually increased the time until we had them out at 4:00 o'clock.

"The floors of the houses are covered with straw in which a little grain is scattered at night after the birds have gone to roost. The moment the lights are turned

(Continued on page 45)

Influence of "Illumination" on Production of Winter Eggs

REPORT OF ADDRESS ON ABOVE TIMELY SUBJECT GIVEN BY PROF. JAMES E. RICE, AT FIRST CONVENTION OF NATIONAL WAR EMERGENCY POULTRY FEDERATION, CHICAGO, JULY 16-18 — DOES NOT DO JUSTICE TO THE SPEAKER (NOTES WERE MADE MOSTLY IN DARK, WHILE LANTERN SLIDE MACHINE WAS OPERATING) BUT NUMEROUS POINTS ARE HERE SET FORTH WHICH NO DOUBT WILL INTEREST AND BENEFIT MANY R. P. J. STUDENTS OF THIS PRACTICAL METHOD OF INCREASING EGG PROFITS

By JAMES E. RICE, Professor of Poultry Husbandry, Cornell University, Ithaca, N. Y.
Reported By EDITOR of R. P. J.

PROF. RICE stated that special illumination, with the object of lengthening the working day, or egg production day of the domestic fowl, has long been used experimentally, but only recently on a commercial basis. He expressed the belief that it is fraught with important results, but also possibly with some dangers; therefore it ought to be studied on a systematic basis and careful records should be kept to determine how far it is safe to go, also which methods will produce the most profit in different sections of the country, meaning, as a rule, the different latitudes. Said he, in substance:

"We want two things: liberal or maximum practical egg yield during the season of high prices of each production year; also we want maximum annual production per hen, per unit, or per flock, within practical limits." Continuing, he said, in substance: "If we get the first, we are pretty sure to get the second, because to get high egg production from an individual, we need to have her begin to lay early in her production year and keep on laying late in her year.

"Cold storage, that splendid modern discovery for the conservation of surplus foods during the period of overproduction, these foods to be used in the time of scarce or insufficient production, has been represented to us here as 'the great equalizer' in supplying our markets to advantage. Poultrymen to date have suffered a great handicap in this matter of 'control of production.'

"If this method of using supplied illumination, thus lengthening the production day of our fowls, checks up as promisingly as now would appear, it will help very materially as a market equalizer in the case of eggs, because evidently by the intelligent use of this method we can increase, in large measure, the number of eggs to be laid during the yearly scarce period—November to February, inclusive—and although these eggs, once laid, will not be laid again, which means fewer eggs in April, May and June, our poultrymen will be far better off in cash returns and we shall have helped to equalize production and also will be meeting the market demand to better advantage.

"Anything that will help poultrymen control production, thus to regulate the supply of his product to the market, bids fair to be of great help to the industry, especially to this important branch of it."

The speaker then took up other matters which relate to the subject of increased egg production per fowl and per flock, including vigor, stamina, proper care, right feeds and feeding, careful culling by selection, etc., then came back to the main subject under discussion. Said he, in substance:

"In this country, fowls come into laying from south to north, much as strawberries come into bearing. In Australia and New Zealand, on the other side of the equator, the reverse is true. Our hens, when cold weather comes upon them, INSTEAD of going into a dormant condition, WILL RESPOND AT ONCE, in the way of egg yield, TO FAVORABLE ENVIRONMENT. If we can duplicate or maintain suitable conditions as to bodily comfort, length of day, etc., they will go on producing. In our country this statement refers to production during November, December, January and February, in the case of fowls that are old enough and that also are in proper condition as to health and surroundings.

Early Hatching Necessary For Desired Results

"There is one thing we surely must do if we wish to get high egg production in the fall and winter months—we must hatch early. Without these early hatched pullets we cannot obtain the desired results, regardless of whether we do or do not use special illumination. We need to have our new crop of pullets 'come into production,' so to speak, at about the time high prices prevail, or begin to prevail for strictly fresh eggs for current consumption. We should realize that these pullets will come into production according to when they were hatched. Late-hatched, immature pullets will not, CANNOT give us the results sought in this case.

"It is a fact well known, that when the first cold days come, all laying stops, regardless of when the pullets or older fowls started to lay. This is a fact in Nature that we must overcome the best we can, partly by breeding, but largely by comfortable quarters. Health, maturity, ample flesh and bodily heat must be present if we are to get the egg yield we want in this period of high prices.

Calls This Kind "Long Distance Layers"

"It will pay to 'select' and retain the late-fall laying hens. We need to select our hens by their ability to GO ON LAYING in the season of high-priced eggs. I call them 'long distance layers.' Under favorable conditions they keep right on laying right into September, October and November. As a rule, these hens will lay at both ends of the period. Be jealous of this kind and make a practice of holding on to them for laying or for breeding purposes.

"We investigators are of the belief that such factors exist as may well be described as 'principles of persistent laying.' It is the duty of students and investigators to determine what they are and to prove their dependability.

"To date it has been disclosed that by 'intelligent selection' and physical examination we can pick out the most vigorous types of hens—those that should lay the most eggs in a given period of time. If you will investigate this method, apply it to your fowls and keep records, you will find that real progress has been made. Try it and see! Merely by a casual inspection of your fowls and the weeding out of those who LOOK INFERIOR, as regards vigor, size, activity, etc., you can, as a rule, increase the annual egg yield one dozen eggs per fowl, no matter what the extent of the flock, and this is well worth while."

The speaker next came direct to the question of the benefits of artificial illumination to increase egg production during the short days of winter in the north temperate zone. Said he, in substance:

"We might seek to accomplish the same purpose by sending our birds to a warmer climate during the winter months—down south, where the days would be longer, also warmer. The question arises: is it merely a coincidence that our period of largest egg production matches the period of longest days—the days of most sunlight. This may not be exactly true but the facts are suggestive. There appears to be something in the length of the 'sun day' that has a direct bearing on egg production by fowls in domestication."

Prof. Rice next discussed the question of "the relations of illumination and nutrition," in the sense that by lengthening the natural day by artificial means during the late fall and winter months, there is more time given the fowls to eat larger quantities and digest more material

for bodily maintenance and egg production. The facts of course are that each fowl must have sufficient food to maintain her physical well-being before the production of eggs can be assured. A short, natural day cuts off her time of eating, also her time of digestion and assimilation. In mid-winter it sends her to the roost at four to half past four in the afternoon and she remains there until seven, half past seven or even eight o'clock of the next day.

This means a 'long fast" in mid-winter, with small chance for her to obtain and digest enough food to produce an egg a day or every other day at this time. Fowls under these conditions average about nine hours of eating, as compared with fifteen hours on the roost. This difference appears to be too great for profitable egg production, from the point of view of the commercial egg farmer. Said the speaker, in substance:

Twelve Hours of Work, Twelve of Rest

"At Cornell, beginning last November 1st, we are conducting 10 experiments, using both pullets and hens. We are using 'light' with the object of comparing results and we hope to draw some helpful conclusions as to the extent that lights can be employed, meaning the length of time they should be used during each twenty-four hours. Over fifty commercial breeders in New York state are reporting to us regularly and our present thought is that the hens do their best functioning on a twelve and twelve hour basis—that is, twelve hours of work and feeding, with twelve hours of rest on the roosts.

"Evidently it is largely a matter of 'carrying capacity.' Our object is to help them over the night till they can again feed themselves. We feel sure that hens can be over-stimulated by this illumination, 'speed-up' process, and we are confident also that this method should not be employed with fowls kept for breeding purposes. Its benefits, we think, will be limited mainly, if not wholly, to the production of eggs for market, especially during the high-price period of each season.

"We suspect, too, that as a result of these experiments we are going to find out much about the KINDS OF FEED that will carry the hens through the night to best advantage and that can be converted into the most eggs, in order that we may perhaps secure an egg a day in the period of high prices, or come much nearer this goal.

"One of the essentials IS HEALTH—health and good size, based on vigor and stamina. If we have a less secure foundation than this to work with, or on which to base our experiments, we shall not get very far. Our birds must be in perfect health or practically so, thus enabling them to digest their food promptly and completely, also to assimilate it and accumulate fat, because without this surplus of fat they will not be good winter layers."

Charts were exhibited by the speaker that showed, by the use of colors, how daylight and darkness were changed in the ten Cornell experiments by the use of artificial illumination. These charts covered the period from November 1st, 1917, to about July 1st, 1918. The amount of illumination varied with the different tests, but in practically every case where the length of time for "working and eating" on the part of the fowls WAS LENGTHENED, as compared with natural conditions, there was a noteworthy increase in egg production, especially up to the "50-50" test, where twelve hours of light (both kinds) was furnished, as compared with twelve hours of night time, or of roosting period.

In this connection, an impressive example was shown, as published in R. P. J. last month as part of the report of the First Convention of the National War Emergency Poultry Federation. Same is republished herewith as follows:

One Hundred Hens With No Lights

	Eggs Laid	Sold for Per Doz.	Receipts
December	14	$ .69	$ .81
January	154	.71	9.11
February	430	.57	20.43
March	841	.43	30.13
April	1401	.43	50.20
May	1605	.38	55.83
June	792	.43	28.39
Total	5237		$194.90

One Hundred Hens With Lights

	Eggs Laid	Sold for Per Doz.	Receipts
December	1410	$ .69	$ 80.08
January	780	.71	46.15
February	548	.57	26.03
March	483	.43	17.31
April	451	.43	16.16
May	771	.38	24.42
June	704	.43	25.23
Total	5147		$235.38

It will be noted by the foregoing that the one hundred hens with "no lights" laid 90 MORE EGGS during the seven months, but that the one hundred hens "with lights" brought in$41.48 MORE MONEY by laying more eggs during the period of high prices.

Point of Special Value to Commercial Egg Plants

Referring to the above example and others like it, Prof. Rice said, in substance:

"These cases show that by this method the poultrymen GET MORE high priced eggs from their fowls and PAY FOR THEM IN LOWER-PRICED EGGS, which is a profitable financial transaction. We do not get more eggs in numbers, so it would appear, but in practically every case we get our eggs at a time when they bring more money. We can't rob Peter to pay Paul completely, but evidently this is true: by the use of illumination, as here meant, you can CONTROL PRODUCTION, so as to supply your trade and hold it. If this proves to be true throughout the important egg-producing sections of the country, it will be a great forward step—no doubt about that. To date this has been one great difficulty: poultrymen could not contract to deliver eggs the year 'round, because during the period of scarcity not enough fresh eggs were available to keep up the supply. It now appears that by lengthening the production day and increasing egg yield during the scarce period we shall be able to overcome, or largely off-set this trade difficulty."

Again referring to the matter of the use of illumination in the case of breeding stock, the speaker said, in substance:

"Illumination should not be placed on breeders in the fall and winter, at which time it gives its best results with commercial egg flocks. During the fall and winter it is not desirable, as a rule, to have your breeders lay large numbers of eggs. In their case we wish to wait for the natural spring time, thus to have the chicks come off when Nature is favorable.

"However, in the early spring months in this northern latitude, in cases where illumination is turned on, it will increase production, also hatchability, as we believe. As a rule it takes two to three weeks 'under the lights' in the fall and early winter for results to make themselves clearly apparent, but the effect is more rapid in late winter and early spring. On this point of added fertility and hatchability, in the case of the use of illumination in late winter and early spring for breeding stock, we have some favorable reports, but we seriously caution poultrymen not to go too far as yet, either in the case of excessive illumination in the production of market eggs, or in the use of this method to increase the egg yield of breeders during the early spring.

"As a matter of fact, this is new territory and our investigations are still in the experimental stage. It is a field of unusual promise, so it would appear, but let us not over-do it—let us not go too far nor expect too much until we have made sure of our ground. Cornell is giving a practical demonstration of its present confidence in this new departure and we shall be glad to report the facts to the public as fast as our experiments are in proper shape for doing so. Meanwhile our records are open to the public and we are glad to give the best advice we have."

(NOTE—The foregoing article is reprinted from the September, 1918, issue of R. P. J.)

Discovery of "Lighting System" in the Northwest

AN ENGLISHMAN JOKINGLY SUGGESTED IT TO PROF. GEO. R. SHOUP, OF PUYALLUP, WASHINGTON, WHO FIRST TRIED ORDINARY BARN LANTERNS—GOOD RESULTS WERE IMMEDIATE—SYSTEM NOW USED EXTENSIVELY IN SHORT DAYLIGHT TERRITORY, WITH IMPORTANT FINANCIAL BENEFITS

By MR. and MRS. GEO. R. SHOUP, Western Washington Experiment Station, Puyallup.

AT the National Poultry Conference, held in Chicago March 29-30 this year, Mr. Frank W. Breed, Seattle, Wash., well-known poultry judge and breeder, told editor of R. P. J. that Prof. George R. Shoup, Poultry Instructor and Investigator at the Experiment Station of the Washington State College of Agriculture, Puyallup, Wash., was a pioneer in the use of artificial illumination for winter egg production. Soon after that we wrote Prof. Shoup, asking him for information on this line, also to send us any bulletins or other printed matter the State College of Washington had published on the subject.

It develops that Prof. Shoup, with the co-operation of Mrs. Shoup, replied promptly to our request, but his letter came to hand during the editor's absence from R. P. J. offices on an extended eastern trip, hence was overlooked until lately, except that its receipt was promptly acknowledged. We now find pleasure in printing said letter in full, as follows:

Puyallup, Wash., April 19, 1918.

Editor R. P. J.:—

"Your letter of inquiry, concerning lighting as practiced in this section, has been given careful consideration and we are mailing you under another cover such bulletins and other printed matter as are now available. We have no idea as to what you may care to use, but we are glad to give you the straight of it.

"These are the prevailing conditions out here. The ranches are small, ranging from five to twenty acres of logged-off land, freely sprinkled with standing stumpage. Either dairy or diversified farming is not to be thought of on these small ranches, unless the income can be supplemented by one or more of the family working in the logging camps or mills. The puzzling problem is to get an income from the rural home the year 'round.

"Poultry flocks that begin laying in January do well enough the following nine months, but must be carried the other three. It is no special trick to have well matured pullets by October or November, but being so far north, our short winter's day gives a short daylight working day.

"An old Englishman calling late on a winter's day, joked us about being so anxious to get eggs in fall and winter and finally suggested that we hang up lanterns to make the fool hens work longer. It sounded pretty good, and we sized up the situation briefly as being a case of having (1) mature stock ready for work; (2) mild winter weather conditions though exceedingly wet, (3) and an abundant supply of green stuff all the year round.

"We shut the pullets in and tried barn lanterns. Fine, except that fourteen lanterns were required for the 120 foot laying house, because it needed to be made bright and shining by 3 p. m. every day, Sunday included. However, the production was so materially increased that we searched for a simpler lighting system, finally coming to use the gasoline lanterns—hollow tube, or private or municipal electricity, according to the location of the poultry plant.

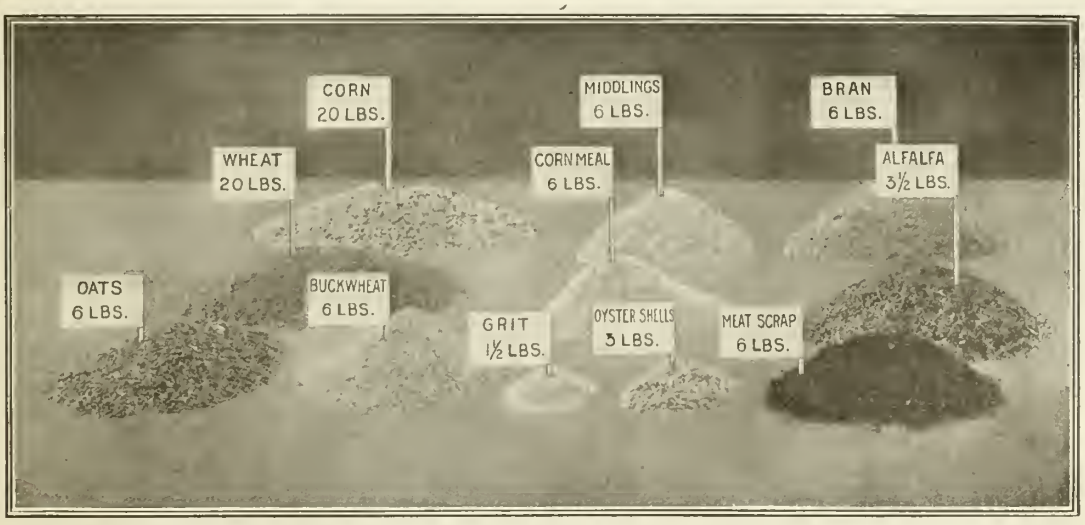
"Along with the lights we use one-fourth inch sprouted oats for the breakfast grain feed; kale, upon which we depend for a high vegetable protein in appetizing and soluble form, and the fresh blood mash for evening dessert.

"Hoping the information concerning these commercial methods with S. C. White Leghorns in the Puget Sound District will show why we ship strictly fresh eggs to localities unable to produce them in winter, we are,

Very truly,
MR. AND MRS. GEO. R. SHOUP,
Per Mrs. Shoup."

The foregoing recital of facts is extremely interesting and shows how these methods often come about—how, as the result of accident, some of mankind's progressive steps are taken. Evidently quite a number of poultrymen located in widely separated sections of the country, stumbled upon this method of increasing the egg yield during the short daylight period of the year. Undoubtedly this is an important forward step—one that will soon be adopted by tens of thousands of poultry keepers in all sections of the country—especially thoughout the North, with the result that large quantities of eggs which otherwise would be laid in the spring and summer will be produced during the late fall and winter, thus equalizing the supply for human consumption and adding materially to the cash revenue of poultry keepers.

(NOTE—The foregoing article is reprinted from the November, 1918, issue of R. P. J.)



BALANCED RATION OF WHOLESOME FOOD NECESSARY FOR HIGH EGG PRODUCTION

The above illustration is one of nearly a hundred that are published in R. P. J.'s latest book on successful poultry feeding, entitled, "How To Feed Poultry For Any Purpose With Profit", by John H. Robinson, Associate Editor of Reliable Poultry Journal. Eggs are a manufactured product. Into them go certain materials. It is necessary that these materials be supplied in "balanced quantities" to insure a large "factory output" on the part of the wonderful little animal known as the domestic hen. A Leghorn will consume seventy to seventy-five pounds of wholesome feed during one year (not counting grit and oyster-shell as food) while the larger breeds—Plymouth Rocks, Rhode Island Reds and Wyandottes—require about five to six pounds more for their annual sustenance and output. To all readers of this book on the use of artificial lights to increase egg production, we recommend Mr. Robinson's new book, as here mentioned.

Practical Advice for Use of "Lighting System"

MAN WHO HAS USED IT A NUMBER OF YEARS WITH FINE SUCCESS IN BACK-YARD POULTRY PLANT ON CITY LOT, BUFFALO, N. Y., TELLS WHAT HE DID, HOW HE DID IT, AND GIVES GENERAL REPORT OF RESULTS SECURED

By WARREN V. CLARKE, Buffalo, N. Y.

READERS of this journal who are following the series of timely articles on the use of artificial illumination for increasing egg production during the short daylight period of the fall and winter, will recall the valuable articles contributed to these columns by Mr. W. V. Clarke, 59 Bird Ave., Buffalo, N. Y., whose city "poultry farm" consists of a space 25x90 feet. Dimensions of house used by Mr. Clarke are 16x18 feet. An electric light is located in the center of this house, near the ceiling. In an article published in February, 1918, R. P. J., beginning on page 1113, Mr. Clarke said:

"The 'secret' of the heavy winter egg yield that I obtained is the use of electric lights night and morning, thus giving the chickens a longer day in which to consume food. I find that you can feed them a less concentrated food by elongating the day. The lights are turned on at 5:30 a. m. and switched off at 7:15 or 7:30 p. m. As soon as the daylight is strong enough they are switched off until three or four in the afternoon, depending on the brightness of the day. Lights are used from October 1st to April 1st with pullets, but with yearlings or breeders they are used from August to February first, hens being rested during February and March so the eggs will hatch well during the rest of the spring and early summer."

Some weeks ago, R. P. J. corresponded further with Mr. Clarke, whereupon he kindly offered to furnish our readers a detailed report of results obtained on this city poultry plant for the year to end October 31, 1918. In acknowledging that letter and thanking Mr. Clarke for his further contribution—to include the annual report—we asked him for "some good, timely advice, to be published in our November issue, a month ahead of the annual report, for the instruction of R. P. J. readers—advice based on your personal experience that will prove helpful to them in the use of the lighting system." To this letter Mr. Clarke replied, under date of October 14th. In his personal letter to the editor he said:

"I wanted to give you something for the November issue and have done so in spite of my recent illness. Hope the facts herewith will benefit my brother poultrymen who are just starting the plan of lighting their coops or hen houses to increase fall and winter egg production. I hope you may be able to visit Buffalo in the near future, when I shall gladly show you around 'my back yard' and give you some further ideas that you can write up, for the purpose of helping R. P. J. readers. That article in your October number by Prof. Waite, telling and illustrating how to pick out the laying hen, is worth the price of several years' subscription."

Following is Mr. Clarke's contribution to this issue—and the instructions and advice he gives are based on practical, successful experience:

Buffalo, N. Y., October 14, 1918.

Editor R. P. J.—

"October R. P. J. came just at the right time as I have been ill for the past week with an infected foot, also a bad cold. I will try to give you the facts, gathered from my experience of the past year.

"In using lights with poultry you are forcing the pullet, not with a concentrated feed, but with a longer period to eat. You can, therefore, feed a ration full of bone-producing food and containing somewhat more fibre, because the bird has a longer time to eat such food.

"I feed quantities of oats—in the mash, as scratch grain, also sprouted. I sprout now in three and four gallon pails, filling the pails about one-third full. In about four days they are ready to feed to the chickens, and how the birds do fight to get them! Oats cost about three cents per pound in Buffalo, and I consider oats the cheapest feed for poultry and the best feed to make a large framed bird.

"When starting the lights in the fall of the year, sort your birds according to size and vitality and place your most precocious pullets in separate pens or coops, using less light with the large, forward birds than with the smaller, weaker ones.

"If you force your forward birds you will bring a semi-molt to many of them in the month of January. The weaker bird will stand the extra light and forcing, not laying as well during the months of November and December, but escaping the molt of the heavier laying birds in December and November.

"By the use of artificial light you will have a percentage of your birds molting from January on to March, and if one has a plant of numerous pens or coops he should sort his birds continuously during the period from January to March.

"You will find a molting bird rather timid and the bird in full laying will crowd her away from the feed. As an example, last March I sorted over one hundred birds and placed forty birds as non-layers in a separate pen. The following day I received three eggs from these birds and in the course of two weeks they were giving me a 30% to 40% egg yield.

"With the use of the lights one can afford to keep most all his pullets from November on to July, because the bird that molts in March and April will start laying again in the late spring and produce eggs when eggs start to increase in price.

"I do no hatching on my plant. I have not the room to keep breeding stock and the cost of raising would be more than buying chicks at $15.00 to $20.00 per hundred.

"This spring I raised about fifty pullets from day-old chicks and bought the balance of my pullets at eight weeks old from Ward's Poultry Yards. In a later letter I will tell the difference in cost of raising the pullets up to November first.

"I had on November 1, 1917, 168 pullets and 19 yearlings. My egg yield from November 1, 1917, up to October 1, 1918, was as follows: November, 2781 eggs; December, 2594; January, 1724; February, 1834; March, 1609; April, 2130; May, 2840; June, 2779; July, 2025; August, 1308; September, 785.

"In keeping poultry in the back yard, with my system of feeding, one can water the chickens after supper, feed the grain as soon as you arrive from work, feed some sprouted oats before going to one's business and directly after supper, so you have your chickens under your control, and the only assistance you will need is the gathering of the eggs at noon in extremely cold weather.

"When my poultry year ends, I will give you an account of the cost of raising my pullets, net profits per month, cost to feed and how this system can be used on a large poultry plant as well as in a back yard.

Very truly yours,

WARREN V. CLARKE."

Use of Artificial Lighting to Increase Winter Egg Yield

IN TIMES OF PEACE AS WELL AS IN WAR-TIME, MAXIMUM EGG PRODUCTION IS THE AIM OF ALL PROGRESSIVE POULTRY KEEPERS—THE PROBLEM PRIMARILY IS ONE OF ADEQUATE NUTRITION—PROLONGING THE FEEDING AND WORKING DAY OF THE HENS BY ARTIFICIALLY LIGHTING THEIR PENS MORNING AND EVENING RESULTS IN GREATER WINTER YIELD—GIVE THE HENS MORE TIME TO EAT AND YOU WILL GET MORE EGGS—MANY POULTRY KEEPERS ARE NOW USING LIGHTS IN THIS MANNER

By PROF. LUTHER BANTA, Department of Poultry Husbandry, Massachusetts Agricultural College, Amherst, Mass.

(First of a Series of Three Articles)

EDITOR'S NOTE: Mr. Banta candidly states that he has not, as yet, been able to collect all of the fragments of the history of the evolution and practical developments of the "lighting" idea as applied to poultry houses. If any of our readers know of persons who have had extensive experience with lights, or who used artificial illumination to increase winter egg production a considerable number of years ago, and they will acquaint Mr. Banta with the facts, he will put this data in such form as will make it promptly available for the information of all Reliable Poultry Journal readers.

It is confidently expected, as a result of publishing in these columns several detailed reports from practical poultrymen in widely separated parts of the country, who have successfully used artificial illumination to increase winter egg production, that many other poultry raisers will be encouraged to take up this plan and give it a trial on their own plants. In this way they will be doing a patriotic work in endeavoring to increase the supply of human food, will help to sustain the patronage and interest of consumers in poultry products by providing a fresh mid-winter egg supply, and will also contribute to our exact knowledge of the practical value of lighting when applied to a still wider range of conditions in various parts of the country, and hasten the development of tried and proved modifications, as compared with its present status.

In the next issue Mr. Banta will take up in detail the various systems of lighting and the accompanying feeding programs employed with success in different parts of the country. Upon request he will gladly confer with poultrymen who desire further information or advice as to the installation of lighting equipment or the management of the same on an efficient basis.

IT appears quite evident that the phrase, "There is nothing new under the sun", was not written by one acquainted with the poultry business. Poultrymen are familiar with the ever-changing aspects of their business as brought about by war conditions, and have frequent occasion for wonderment at the astonishing rapidity with which new ideas and discoveries come to the front. Often what we consider brand new ideas are, in reality, older ones re-discovered and revived. This idea of using artificial illumination to increase winter egg production is an example of this sort. I think it was about four years ago that Professor O. B. Kent, of the Department of Poultry Husbandry at Cornell University, Ithaca, N. Y., discovered that what we thought was an entirely new idea in selecting heavy layers by their bleached-out shank color toward the end of the laying season, had been observed and reported in one of our oldest and most widely read agricultural journals some thirty years before. It seems that a poultry woman with a few hens had observed that her best layers bleached out their shanks, but as no one else came forward to substantiate her claims or perhaps even took the trouble to look into the matter, this idea, along with many other no doubt equally valuable ones, was consigned to the scrap heap, to be later "re-discovered."

Supposed Origin of the Lighting Idea

Professor James E. Rice, of Cornell, while doing Farmer's Institute work in northern New York State about twenty years ago, ran across a poultryman who had used electric lights to increase the length of his hen's feeding days in winter, and, as a consequence, had observed a marked increase in their egg production. To the best of my knowledge it is not known where or how he obtained the idea or suggestion which led him to try the experiment. Probably it was original with him. The fact that he was the owner of a local electric light plant, doubtless explains the reason why he ventured to spend money on what must, at that time, have been considered a

WHERE "LIGHTING SYSTEM" IS IN COMMON USE

Fig. 1—Map of the northwestern corner of the state of Washington. This is the area where many poultrymen now are using lights to increase winter egg production. Has been a success there several years.

foolhardy scheme. It seems reasonable to suppose that this pioneer was the victim of so much derision and joking because of his work, that he finally determined to give up any further effort along this line. Some persons undoubtedly sarcastically remarked about his efforts to make his hens lay two eggs a day by alternating eight hours of darkness with eight hours of artificial light, or some other similar impossible stunt. The tendency of this type of skeptic is always to miss the point completely himself, and to make the whole idea seem so utterly stupid and preposterous that the mere mention of the thing provokes a loud laugh and a unison of catcalls.

I recall how this attitude was taken by a few "doubting Thomases" in relation to a large and successful poultryman in western New York who last fall undertook the use of the lighting program for the first time. Many insisted that the Humane Society should be appealed to as Mr. X intended to work his hens night and day without

rest of any kind. Of course this was widely at variance with the plan my friend had in mind, as he simply believed that it was just and proper that hens have as long a time to work and eat in winter as during the period of long days, and he decided to arrange his facilities so as to accomplish this aim.

A poultryman connected with one of the large Leghorn farms in New Jersey wrote me last winter that over twenty years ago he successfully used lights to increase winter egg production. So we must conclude that it is not a brand new idea at all.

Since these first tests many other poultrymen in widely separated parts of the country have carried on the good work in endeavoring to ascertain the real truth about this interesting problem. Another poultryman in northern New York used lights about fifteen years ago. In December of last year a poultryman in western New York State told me that he had used lights in his laying house twelve years before when he was a resident in one of the suburbs of Liverpool, England. He had run a grocery business in the city, and being employed in the store in the early evening, he did not arrive home until ten or eleven o'clock at night. He went immediately to his poultry house, called the birds from their perches by means of lantern light, and gave them their evening meal. He then raked the litter into a pile, scattered sufficient grain therein for their morning feed also and about an hour later, before retiring, and after the birds had returned to their perches, he removed the lantern from the house. This late evening feed he found to be very advantageous in increasing the winter egg yield.

After correspondence with several hundred poultrymen who have been using lights in most of the northern and eastern states of this country, and in the adjoining provinces of Canada, I find lights are being used most extensively in three restricted sections, namely in the states of Washington and Oregon, and in Erie County, New York. The accompanying map, Fig. 1, will show the portion of Washington where thousands of poultrymen are using lights, particularly about Tacoma, Vashon, Holly, Lynden, Ferndale, Langley, Silverdale, Puyallup and Coupeville in Kitsap, Pierce, King, Snohomish and Whatcom Counties, and on Whidbey Island in Puget Sound.

Professor J. E. Dougherty of the Department of Poultry Husbandry of the University of California, tells me that most of the large commercial egg farms of Southern California also are using lights. This means many hundreds if not several thousand farms. As described by R. S. Moseley in the June number of R. P. J., page 441, lights are being rather extensively used throughout Erie County, N. Y., which is the county in which Buffalo is located. Over 150 poultrymen have been using lights in this region for from one to three years each.

Due Credit to Mr. and Mrs. George R. Shoup

In both the Washington and New York districts the idea spread following the signal success of one individual poultryman. To Mr. and Mrs. George R. Shoup, now poultry specialists at the Western Washington Experiment Station, Puyallup, Washington, doubtless is due the credit for first pointing out the full value of winter lighting to poultrymen in that state, and developing a wise and conservative program for its permanent use. Professor Helen Dow Whitaker, formerly of the Washington Experiment Station at Pullman, writes me that doubtless others tried out lighting at as early a date as did the Shoups, but probably none so thoroughly and with the logic of the plan so clearly in mind.

The Shoups were formerly large poultry producers at Lynden in western Washington. Mr. Shoup wrote me that they got the lighting idea from noting the action of hens fed by lantern light. With several thousand hens to feed, they found it necessary to begin work before daylight in the winter season. Upon the arrival of the caretaker in the pen with a lantern, or even at the striking of a match, all the birds would hop off the perches in one white wave, and immediately begin to work and eat greedily. The experience at the Shoup hennery was like that secured by another West Washington poultryman who expressed his experience in the following slang phrase—"We simply put the lights over and the hens laid for it."

Many isolated poultry raisers in all parts of the United States have apparently run onto the idea independently, in many cases in very interesting ways. Professor James Halpin of the University of Wisconsin, has written me of finding a poultryman in the far north of that state using lights several years ago. He happened to stumble on the idea in this way: he had his horse-barn wired for electricity. Directly adjacent and separated only by a wire door, was the end pen of his laying house. Very early on winter mornings he would visit the barn to groom and feed his horse. The electric lights being on, the first laying pen was sufficiently well lighted so that the birds could see to scratch and eat. The owner noticed that these birds laid many more eggs than the occupants of similar breeding in the other pens. In this way he was led to install and adopt the winter lighting schedule as part of his permanent program of poultry management.

Why Hens Require a Longer Working Day in Winter

Comparing the seasons of heaviest egg production in New York (as typical of the United States) and in Australia, we find that they are exactly opposite. In other words, in the southern hemisphere the heaviest production is secured in October and November (their "spring"), while with us April and May are normally our best months. Apparently, then, there is a fairly close correlation between egg production and season, because the seasons are likewise directly opposed in the two hemispheres.

Evidently there is a very close relationship between the number of hours of daylight during the various seasons of the year and egg production. Cornell University has charted the egg production of both countries (Australia and the United States) and finds that approximately the lowest production obtains during the shortest days and the heaviest production at or just previous to the longest day.

In this connection I quote from a booklet entitled, "A Revolution In Egg Production," by Mr. George G. Newell, of Congress Park, Ill., who states: "On June 21st in the latitude of Chicago and Boston, the sun rises at about four twenty-three a. m., and sets at about 7:40 p. m., making a day of fifteen hours and seventeen minutes. In the same latitude on December 21st the sun rises about seven twenty-six a. m., and sets about four thirty-one p. m., making a day of nine hours and five minutes. This is a difference in length of the hen's business day of six hours and twelve minutes."

This is a variation of over 40%. Also many of the winter days afford only about seven hours sufficiently light for the birds to see to scratch and eat freely. This means a minimum day over 54% shorter than the longest day in June. Yet, in addition, this occurs at that time of the year when the atmospheric temperatures range the lowest, and consequently when the greatest demands are being made upon the reserve food nutrient supply of the

bird in order that she may merely maintain her normal body temperature, which is very high, comparatively speaking, in a fowl, averaging 106 degrees Fahrenheit.

Whole Problem Primarily One of Adequate Nutrition

Professor Halpin, who used lights in 1907 while in charge of the Department of Poultry Husbandry at the Michigan Agricultural College, examined the crops of fowl on the perches at midnight in midwinter, and found them in all cases nearly or quite empty. Evidently a bird cannot possibly cram enough food into her crop at four thirty or five o'clock in the afternoon to carry her through to the next morning's meal. In other words she is only working on a part-time basis as her mill (gizzard) is prepared to grind food continuously, but its output is necessarily limited by the capacity of the hopper (crop) supplying it. Therefore lights were tried to supplement the natural day-light hours, sufficiently so that the hen might eat her evening meal at about eight o'clock in the evening; and likewise electricity was used to provide an early breakfast at about 6 a. m. By this method Prof. Halpin found the bird's digestive system was kept working through a greater portion of the day, that she accordingly consumed more food, and, as a consequence, had a larger supply of food nutrients available, was able to keep her body more adequately nourished and had a larger net balance of the necessary ingredients to manufacture eggs more freely. For generations hens have wanted to lay in winter, but could not.

Professor J. C. Graham, of the Massachusetts Agricultural College at Amherst, has observed that birds distend their crops with food to a greater degree in the fall and winter afternoons than during the spring and summer. Without a question this is a manifestation of the bird's endeavor to counteract the effects of the short winter day to the very limit of her ability, or capacity, in this relationship.

The logic of the whole idea is so simple and based upon the most elemental laws of physiology and nutrition to such an extent, that it is astonishing that it has not become a matter of common knowledge and practice before, though it has been known and used by a few scattered poultrymen for many years.

I wish to quote a western Washington poultryman who has used lights for seven years, and who discovered these fundamental principles while working independently on his own plant.

He says: "We began using lights seven years ago, using three ordinary lanterns hung by harness snaps from the center plate, being equally spaced in a house 16x40. We figured that, as a hen's capacity for food was very small, the reason for the scarcity of winter eggs was that she did not have time to eat enough, and so, in an endeavor to produce conditions as nearly like those when the eggs are most plentiful, we figured on keeping the birds busy eating for 13 to 14 hours each day. Our contention—to make the fall and winter conditions as near the natural conditions at the natural time of reproduction —has proved eminently correct. Our pullets at the present time (November 18, 1917) are laying from 70 to 84% of about 80% No. 1 eggs."

Fig. 1—Shows the outside of a far-western poultry house, the interior of which is pictured in Fig. 2. Note the open wire front, and the long outside trough which greatly facilitates the feeding of moist mash with a minimum expenditure of labor. The birds eat from the trough through the wire front.

Here, as in all branches of agricultural science, we find the FACTS are discovered invariably by the farmer on the land; later the scientist in his laboratory proves the REASONS for the observed phenomena.

I have found that poultrymen in at least twenty-one states of the Union, in four provinces of Canada, and in England have used lights for increasing winter egg production WITH SUCCESS IN EVERY INSTANCE. Taking into consideration the wide variety of conditions represented in these widely separated localities, and the sound basis of scientific fact underlying the philosophy of the whole plan, it can hardly be maintained that the scheme is without great value, particularly in its practical application to counteract high feed costs, notwithstanding the efforts of certain skeptics to prove it a mere "pipe dream."

(Persons particularly interested in this subject will find some very interesting and instructive reading on this subject in the booklet referred to, entitled "A Revolution in Egg Production," by Geo. G. Newell. This may be procured from the Reliable Poultry Journal Publishing Co., Quincy, Ill., price one dollar, postpaid. Mr. Newell presents many pages of data in connection with his experiments in the use of artificial illumination.)

(NOTE—The foregoing article is reprinted from the November, 1918, issue of R. P. J.)

Use of Artificial Lighting to Increase Winter Egg Yield

IN THIS INSTALLMENT PROF. BANTA TAKES UP "ONE OF THE PREVAILING PROGRAMS OF MANAGEMENT TO ACCOMPANY SCHEDULES OF LIGHTING" IN SECURING BEST RESULTS — QUOTES AT LENGTH FROM WRITINGS OF MR. AND MRS. GEO. R. SHOUP, STATE OF WASHINGTON, IN WHICH THESE PIONEERS PRESENT THE SUBJECT IN A WAY THAT ANY EARNEST PERSON CAN READILY UNDERSTAND — THEY TREAT OF SANITARY HOUSES, USE OF PULLETS, WHAT AND HOW TO FEED, WHEN AND HOW TO USE LIGHTS, ETC.; ALSO TELL WHAT TO DO IN CASE OF BREEDING STOCK

By PROF. LUTHER BANTA, Department of Poultry Husbandry, Massachussetts Agricultural College, Amherst, Mass.

(Second of a Series of Three Articles)

IT is my desire, in presenting several of the prevailing programs of management to accompany schedules of lighting in various parts of the country, to point out the nicety and skill with which these are adapted to the prevailing conditions and requirements of the sections concerned. Of course this same thing may be observed in nearly all phases of poultry management, but is of particular interest in this connection when one considers the relatively short time through which the scheme has been practiced on anything like an extensive scale.

As I mentioned in the November issue of R. P. J., lights are being used more generally by several thousand poultrymen in the western part of the State of Washington than in any other part of the world. I cannot do better than to quote directly from Mr. and Mrs. George R. Shoup of the Western Washington Experiment Station, from articles appearing in the March, 1918, issue of the Journal of the American Association of Instructors and Investigators in Poultry Husbandry, pages 44-47 inclusive, as well as the Monthly Bulletin of the Western Washington Agricultural Experiment Station, Vol. 5, No. 9, for December, 1917, pages 134-136 inclusive:

"When poultry came to be considered as a likely business instead of a side line, it was evident that an income eight or ten months and a shortage the other months of the year seriously cut into the yearly net income. Facing this condition, the writers worked early and late to contrive a way to get an income over expenses during those lean fall months, and at the best were able just to meet obligations. We realized that our pullets were fully grown, well feathered and healthy, so we felt sure they were in the proper physical condition to lay if we were clever enough to give the necessary environment. We had comfortable hen houses, protected with curtain fronts, a balanced ration, and pullets as well as hens, but the egg yield was from 10 to 14% for October and November each year, with the maximum yield coming up to 75% during the spring months.

"By analyzing natural spring conditions as nearly as possible, it was readily seen that the factors were:

"First—Long daylight.

"Second—Tender, succulent green feed.

"Third—A goodly supply of bugs and worms.

"Fourth—No cold rains and bleak winds.

"Along with the conditions we already had, Nature added these four items each spring, with the result that the egg production was much increased. Our cue, then, was to imitate Nature.

"The first season (1912) we tried, by using barn lanterns, to give the added working hours; by supplying fresh kale stalks while lighting in the evening, to induce the birds to stay off the perches, and by adding enough animal protein to the wet and dry mashes fed, to make up for the bugs and worms. Our hens, with no artificial conditions like spring, gave 3½% production in November 1912, while our pullets, with the added factors above, gave a yield of 37%. The following spring the hens made 65% in April as against the pullets 68%. There was 10% lower production in spring when all flocks were laying and the price of eggs was 20c per dozen, against 23% increase in production when the price was 53c in November. THIS THREW THE BALANCE TO THE PROFIT SIDE OF THE LEDGER EVERY MONTH THAT YEAR, and from that beginning, improvements have been added. Better means of lighting came into use, and the range of animal protein was enlarged from sour milk only to beef scrap, fish meal, buttermilk, fresh blood, ground fresh liver, fresh ground green bone, and salted-down flesh of farm animals. It is now not uncommon to find selected commercial flocks in Western Washington with a fall and winter yield of 60 and 65% from the pullet laying pens, and a spring yield from 60% down to 50% by July first. This means that the flock is trap-nested and culled as fast as non-producers are found, and that each and every factor favorable to uninterrupted production is carefully followed.

"Indispensable to this high production are the following items:

1. Sanitary Houses

"Any chicken house flooded with daylight and fresh air without drafts will be a satisfactory place for these pullets. Control of weather conditions inside the coop can be arranged by ventilators in the roof (see Fig. 1, page 35) and a muslin or flour-sack roller curtain over the front wire-covered opening. The open front and rear window low down under the droppings boards, supplemented by a skylight in the ventilator, are sure to give biddy a light floor to work upon; and to make the conditions as spring-like as possible, artificial light is added during the short days of fall and winter, starting at 6:00 a. m., and continuing until 8:00 or 8:30 in the evening. The roller curtain over the front makes a difference of ten or fifteen degrees between the outside weather and coop temperature in winter weather, as well as being an adequate protection against winds and storms. Clean litter on either cement, asphalt or wood floor is absolutely necessary for confined birds to get enough exercise to maintain health, and a good dust reduces the labor of keeping the birds free from lice. A clean house, kept so by daily gathering the droppings from the droppings boards and daily scrubbing the water buckets, is of first importance. Wet, dirty litter, accumulated droppings left day by day, dirty water and milk dishes, and a house infested with mites will make money losers of the best flock of pullets ever raised.

2. Pullets

"All pullets hatched in the spring and properly grown should be in full production (50 to 65%) when the egg prices are soaring; and the skill in mating, raising and feeding is shown by the fall income from these pullets. The most profitable Leghorn pullets are hatched from the first week in March to the last week in April, the hatching dates crowding back a little earlier year by year as Coast breeders succeed in controlling the pullet fall production. The heavy breeds need to be hatched in February and March to reach maturity at the right time in the fall.

3. Feeding

"Feed must be suited to the purpose not only of building the body of the growing pullet, but also supplying needed warmth for winter, and giving enough raw material besides to permit the manufacture of the egg. This means that the ration must have variety, palatability, digestibility and quantity as well as moderate cost. As this latter item, cost, is much discussed now, the various feeds are shifted

about, and substitutions made that were not thought of until the war crisis came upon us.

"The schedule followed every fall and winter so far is below, and with this as a basis, each year's grain supply and prices will determine what shifts can be made.

Maximum Feed For 100 Leghorn Pullets When Laying 60 to 70 Eggs Per Day in October, November and December

6:00 a. m.—Short sprouted oats, 14 quarts. Obtained by sprouting 6 quarts dry oats. Fed by artificial light in good clean litter.

8:00 a. m.—Clean water in clean bucket (not ice cold)—12 quarts.

8:30 a. m.—Clabbered milk or buttermilk. Six quarts.

3:30 p. m.—Mixed grain. 10 quarts (2 parts wheat to 1 part cracked corn.)

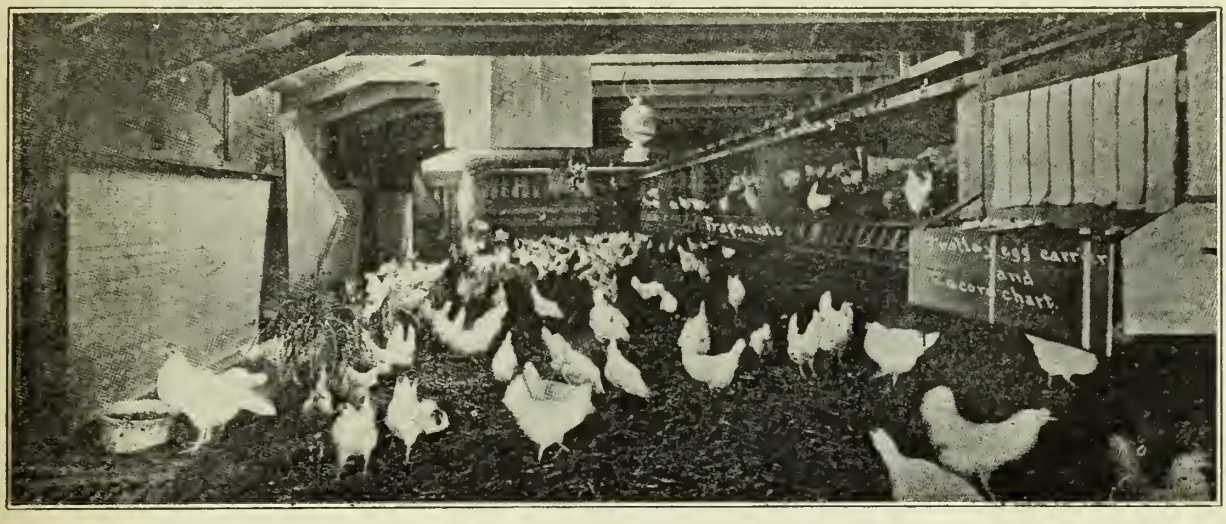


Fig. 2—A busy, winter-night scene at 8:30 p. m. on a large commercial egg farm in the western part of the state of Washington. See exterior view, Fig. 1. Three gasoline lanterns are shown, suspended from rafters midway of the pen, which light the house its entire length. Suspended from the roof are the ventilator levers that operate the ventilators shown at the ridge of the house in the exterior view, Fig. 1. Note also the dropped muslin curtains at the left. Windows are provided in the rear wall, underneath the droppings boards and trap-nests. Observe how many birds are eating the kale, in the foreground to the left in the picture.

4:30 p. m.—Lumpy, wet mash, 7 quarts. Made from egg mash (formula below) 5 quarts, water 3 pints, blood (fresh) 1 pint. Twice a week fresh cut green bone 2 lbs. instead of the blood.

4:00 to 4:30 p. m.—(According to the weather) light lanterns (see Fig. 2.)

5:00 p. m.—Fresh water (not ice cold.)

7:30 p. m.—Kale, 2 large stalks (fed in racks or hung from roof.) See Fig. 2.

8:30 p. m.—Lights out. The egg mash (dry), shell and grit are in self-feeding hoppers open all of the time.

Dry Egg Mash

"For fall and winter use in hoppers open all the time:

2 parts wheat bran.
1 part wheat middlings.
1 part feed cornmeal.
1 part soy bean meal or proteina.
½ part meat scrap or fish meal.
¼ part flake charcoal.
1-6 part sand (the safeguard against indigestion.)
¼ part alfalfa meal (to accustom fowls to taste should the green food run out.)
1 part sifted ground oats (where short-sprouted oats are not fed.)

"This mash may be varied according to special needs. For instance, where there is a shortage of kale, more alfalfa is allowed. When looseness of the bowels is noticed, more charcoal is added. When constipation shows, more bran is put in, and where fresh blood and green bone are limited, more meat scrap is supplied.

"Bear in mind at all times that to get from 50% to 70% egg yield in October, November and December, requires the combination of all of the above factors, operating all together at one and the same time, to take egg production out of the realm of uncertainty and establish it on a basis of commercial quantity production at the will of the owner.

"The use of different types of lights varies according to location. In this latitude the days in winter are so short that some artificial light seems to be needed. The following ways of lighting are in use:

"Where no other light is available, the cold-blast barn lantern burning kerosene is used. It needs daily care and great caution to see that the light does not rise too high and set fire to the building. The most commonly used light is the gasoline lantern with the large fount. This needs filling only once a week, lights a radius of fifteen feet, is a brilliant light, and costs three cents a day to run. Another gasoline light is known as the hollow wire system. In this system the gasoline is forced from a large supply tank through a hollow copper wire, by air pressure in the tank. Each light has to be generated separately, and the wire sometimes gets clogged, and is also liable to spring a leak at the joints.

"The most satisfactory gasoline mantle lighting system for the long houses is the tube system. The gasoline is first forced into a large generator, which makes sufficient gas for all of the lights. This gas is led into inch or larger gas pipe, which has an air intake from outdoors. The air and gas are mixed automatically to the correct proportion (95% air to 5% gas), and each mantle is then lit with a torch or match. There is no delay in lighting after the one generator is heated, and no dust from the house is drawn into the lights and mantles.

"The running expense of either of the latter two systems is about 3c per light, and 3c for the generating light, with gasoline at 20c per gallon. The supply tank of both of these systems is filled once a week.

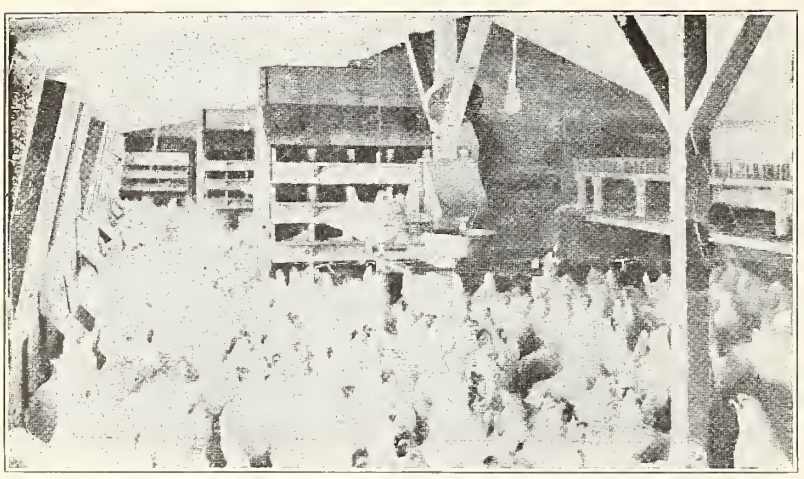
"Where size of the plant warrants it, and the capital is adequate, private electric plants are frequently installed. If one is so fortunate as to be able to buy electric current, it is quite the most satisfactory light used.

"As the system of lighting the coops during the fall and winter spreads among the poultrymen, the tendency to go on the theory that if a little is good more is better, caused some to light too early in the morning and too late at night, with the result that the birds made as high as 90% for a short period, and then went to pieces, AS ANY OVER-WORKED CREATURE MUST. Others who did not understand the right combination of all the elements, tried to get results from poorly balanced conditions, and these folks were disappointed in the production

and the health of their flocks. Still others used lights with their breeding flocks to the detriment of their hatching eggs. These errors are gradually being overcome, and moderate lighting in this particular locality, where green food is taken from the fields every month of the year, and the birds are kept shut in the large, well-ventilated houses from the time they are shut in in the fall to escape the cold rains until spring breaks, is coming into common use, both with the large commercial flocks and the small ones."

Special Lighting For The "Breeders"

Mr. Shoup advises me that they advocate a greatly reduced program of lighting for PART of the breeders, none whatever being used with the remainder. Pacific Coast poultrymen, in common with those in the East, are learning the value of EARLY HATCHING. It has been found out there that the best time to light the breeding hens is December 1st, enabling a 60% production by December 15. This permits January hatching. However, these same birds produce so heavily through December, January and February that their hatching eggs are very poor in March and April. So it is the custom to reserve another flock for the later hatching eggs, since the old hens, without the addition of artificial lighting, do not reach their maximum yield until the first of March in the state of Washington. Mr. Shoup also reports that they have had very good results in using February hatched pullets, which have gone through a partial molt, as early breeders, carrying them under lights from October 1.



Interior view of laying house on an intensive egg farm near Detroit. Electricity is used to provide the necessary artificial illumination.

This program appears to be about perfectly adapted to the conditions found on the commercial egg ranches of the northwest. Small poultrymen will doubtless rebel against such an elaborate scheme of management, but this program has been formulated for the intensive producer, and radical modifications may be made to adapt the use of artificial lighting to the needs of the small producer. Mr. Warren V. Clarke has explained such a system in R. P. J. in the November issue (page 32 herewith), so it is unnecessary for me to elaborate on this point. In the present state of our knowledge I believe that this schedule is the nearest approach to a scheme of poultry management which shall, when embodying future modifications, REALIZE THE HIGHEST POSSIBLE WINTER PRODUCTION COMMENSURATE WITH THE MAINTENANCE OF THE FOWL IN A STATE OF GOOD HEALTH AND VIGOR.

Popularly Used in Western New York

In Erie County, New York, lighting is being used rather extensively and very successfully. The reason for this local development has been the fact that electric current generated by Niagara Falls water power is very accessible and very cheap. Some farmers and poultrymen by virtue of quantity consumption, are able to obtain a 3 to 5c rate per kilowatt hour.

Mr. R. S. Moseley, formerly in charge of the Cornell poultry project at East Aurora in Erie County, outlines two prevailing schedules of management commonly practiced. So successful have the trials proved that practically all of the fifty poultrymen who are "Project" members are now using lights, as well as about 100 other plants in the same approximate locality.

In one schedule, lights are used only from dusk till 9 o'clock in the evening. In the other plan they are employed from 5 or 6 a. m. till daylight, and from dusk till 8 p. m. Dry mash is always before the birds. One to one and a half quarts of scratch grain per 100 hens is fed at 7 a. m. in a clean straw litter about 8 inches deep. Between 6 and 7 p. m. 100 hens receive 5 to 6 quarts of scratch grain. In addition some use a moist mash at noontime, the same being fed in long wooden troughs. At about 7:30 p. m. the lights are dimmed down, and they get the signal to retire. At 8 p. m. all light is extinguished. Natural gas, kerosene lamps and lanterns, gasoline lanterns and acetylene have all been tried as well as the electricity before mentioned. All seem to give equally good satisfaction provided there is sufficient reflection so that the birds can see sufficiently well to readily pick grain from a straw litter. Usually a 60 candle power light is employed to a 20x20 pen for 100 hens.

Some interesting conclusions appear from the experiences of the Erie County poultrymen. It has been found very essential to use every practical means to keep the birds BUSY during their lengthened day and also well supplied with green food. Particularly satisfactory are heads of cabbage suspended about 18 inches off the floor. By incessantly leaping for this food, they are kept down off the perches, and thus their interest and activity sustained.

Again it has been found that the ration need not be so high in animal protein and low in nutritive ratio as when the fowl experience the normal period of winter daylight. The amount of meat scrap may be reduced 15 to 20%, and a more bulky mash employed. The latter may be accomplished by increasing the ground oats, gluten feed, or by utilizing alfalfa meal, or short clipped clover.

Providing pullets are nearly fully developed, lights start them laying in 10 days to two weeks. Practically all pullets that have average vitality start to lay within two months at the extreme from the time lighting is commenced. Less culling need be done with fall pullets in order to maintain a high average annual egg production when the length of the feeding day is prolonged by lights. If pullets are desired for breeders, it is well to select the first ones that start to lay, and place them under normal unlighted environment.

It has been found not to be advisable to use lights on the breeding hens all winter, as the hatching eggs often show low fertility and hatchability, and the chick very poor livability. Lights may be used on yearling, two and three year old hens with good results. Hens molting in August and September lay well under lights through November and the balance of the winter. It has been found that where heavy winter production is obtained, in all cases the production in late March, April and May (when eggs are lowest in price) is below the normal of the prelighted period, that is, that commonly obtained in unlighted flocks in these spring months.

(NOTE—The foregoing article is reprinted from the December, 1918, issue of R. P. J.)

Use of Artificial Lighting to Increase Winter Egg Yield

IN TWO PRECEDING ARTICLES HAVING GIVEN THE "HISTORY" OF ARTIFICIAL LIGHTING OF POULTRY HOUSES TO INCREASE WINTER EGG YIELD, THE REASONS THIS PLAN "WORKS" WITH OUR DOMESTIC HENS, AND THE METHODS EMPLOYED TO PROLONG WINTER "DAYLIGHT", THE AUTHOR NOW CITES A NUMBER OF CASES WHERE THIS PLAN SUCCEEDED AND GIVES TABLES SHOWING RESULTS OBTAINED—ARTIFICIAL LIGHTING PRODUCES A MORE EVEN DISTRIBUTION OF EGGS DURING THE YEAR

By PROF. LUTHER BANTA, Department of Poultry Husbandry, Massachusetts Agricultural College, Amherst, Mass.

(Third of a Series of Three Articles)

IN the two previous articles of this series, I have endeavored to present a general background of the lighting idea as regards its philosophy and the scientific facts underlying same, the origin and historical development as far as it is known at the present writing and typical applications of these fundamentals in practice by representative poultrymen in various sections of the United States.

No doubt many poultry producers will be more interested in tabulated results from a few plants where conspicuous success has attended the installation of simple lighting equipment and the use of a conservative program of lighting such as I recommended in Part II. This data is valid and impartial to the best of my knowledge and belief, and represents a fair and just comparison of resultant production under "natural" conditions (without lights) with that obtained with winter lighting from birds of identical breeding either in the same year or in successive years, as indicated in the accompanying tables, and upon the same farms and with the same attendants in each case.

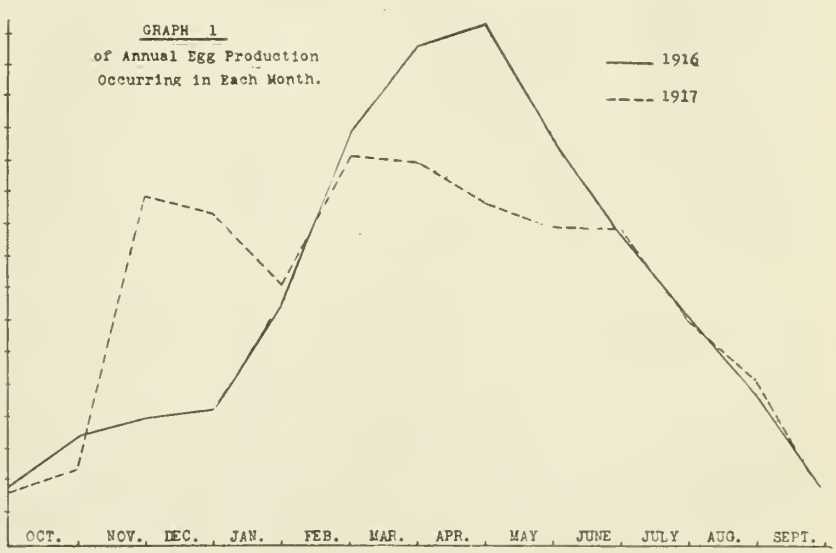
I trust readers will not misconstrue my purpose in presenting data of this sort, as I have no desire to mislead anyone to conclude that these were formal "experiments," conducted under exact control conditions such as might obtain were they carried on under the supervision of investigation experts at our Agricultural Experiment Stations. I have always believed that when comprehensive data from the latter named sources was unavailable, as is necessarily always the case when so-called new ideas arise, the collection and presentment of perhaps less accurate statistics is entirely justifiable. In this case in particular, correspondence from many states is indicative of the great and growing interest manifested in this subject by practical poultrymen. Departments of Poultry Husbandry at our Colleges of Agriculture are being besieged with requests for information and advice. Obviously in times like the present all who can contribute information even of the slightest value should feel free to do so. This is demanded by the common good of our great industry, and by all concerned in its progressive development.

In Table 1, I have presented the record of two flocks of S. C. White Leghorns on a farm in Erie County, western New York. These records cover two years' time. During the year October 1, 1915, to September 30, inclusive, 1916, the flock averaged 660 layers. In the second year October 1, 1916, to September 30 inclusive, 1917, the flock averaged 650 layers. All of the stock was of identical breeding in each case so far as is known. Hatching dates, feeding and other items of management were definitely comparable for the two years, except that in the second year all birds were subjected to artificial lighting, using natural gas as fuel, from November 16, 1916, to April 1, 1917.

Table No. 1

	Eggs Produced Oct. 1, '15-Sept. 30, '16 660 Layers No Lights Used	Eggs Produced Oct. 1, '16-Sept. 30, '17 650 Layers Lights Used 11-16-'16 to 4-1-'17
October	1022	1104
November	1993	1622
December	2308	7376
January	2429	7062
February	4360	5517
March	7504	8298
April	9151	8169
May	9581	7259
June	7470	6802
July	5742	6747
August	4161	4820
September	2729	3499
	58450	68275

It will be noted that the greatest differences existing in the monthly production of the two flocks are in respect to their winter egg yields. During December, January, February and March in the first year only 16,601 eggs were produced, while in the same period of the second year 28,253 eggs were produced. This is an increase of 70.2%.



Graph 1—This sketch shows the effects of using artificial lights in the poultry houses on a New York State farm. Instead of the "peak" of egg production being in March, April and May when all other hens are laying, there was heavy production in November and December and in February and March, while satisfactory production extended from November to July.

In table 2 will be found the percentage of the total year's production which occurred in each month.

Table No. 2

	First Year	Second Year		First Year	Second Year
October	1.7%	1.6%	April	15.6%	12.0%
November	3.4	2.3	May	16.4	10.6
December	3.9	10.8	June	12.8	10.0
January	4.1	10.3	July	9.8	9.9
February	7.4	8.1	August	7.1	7.0
March	12.8	12.1	September	4.7	5.1

Uniform Distribution of Egg Production

It will be noted that in the second year, beginning with December (the next month after lighting was begun), a remarkable constancy of production was maintained almost without a break, and that this averaged from 10 to 12 per cent per month, and was maintained for eight consecutive months. On the other hand in the first year we find the customary lack of uniformity in the distribution of egg production, as during March, April, May and June there was 57.6 per cent of the total annual yield.

Using the months of October to March, inclusive, as winter months, we find a total of 33.3 per cent eggs produced, while in the second year the percentage is 45.2. This seemingly slight difference of 11.9 per cent is of far greater importance than the figures would indicate, since it must be remembered that eggs command the highest prices in this period. Also, it has long been an unattained ideal on the part of the poultry producer, to maintain a fairly uniform production through the twelve months of the year. If this were possible a fairly uniform and steady income would be obtained, weekly or monthly uniform contracts could be made, and perhaps of even greater importance would be the fact that the consumption of poultry products would be appreciably increased by their constant rather than seasonal availability.

The foregoing data indicates that lighting will, without doubt, be of great value in the future in attaining this uniform distribution of production; when used in connection with very early (March and April) hatches, that the pullets may come into laying as the hens are dropping off, and by distributing three or more hatches through this spring period that later pullets may come into laying as the earliest and most precocious ones go into a fall molt. It appears a certainty that with future perfection of detail, this system may provide an almost perfectly uniform distribution of egg production throughout the twelve months of the year. Indeed, some poultrymen and at least one Experiment Station have already attained results which closely border upon this ideal.

This distribution attained on this New York State farm is more vividly shown in Graph 1 (page 39). As many poultrymen who have used lighting have told me, it is apparently possible to advance heavy production two to three months by the use of lights. As one might expect, a subnormal spring egg production (March, April, May and June) seems to follow logically.

In this particular case there was an increase in the average egg production per bird for the year of 17 eggs. This may or may not be significant. It should be constantly borne in mind that the objective of the lighting program is to change the distribution of egg production, and not to increase the average annual yield per hen. Probably on the average, the total annual production is little if any increased.

A California Record

The second farm from whose records I should like to present data is located at Petaluma, Calif. Again the birds are S. C. White Leghorns. In the former case the birds were pullets, yearlings and two-year olds. In this case they were all yearlings, hatched early in March, 1916. To show exactly the kind of stock occupying each pen, I am presenting the owner's report verbatim.

"Pen No. 5 was the first pick of the brooder house; by that I mean they were the largest and best developed at four months of age. Pen No. 6 was second pick. As the No. 5 pullets greatly outlaid those in No. 6, I consider the former as always being the superior pen.

"I put the lights in No. 6 on October 1, 1917, to see if I could get them to produce some of the eggs they should have laid earlier in life. I really believe that without the lights they would have laid many eggs less than they did from October 15, 1917, to March 1, 1918. Of course, this is not a conclusive test by any means, but in my mind, considering the difference between the two pens, I am satisfied with it. This year, beginning October 1, I have three houses running with lights."

Electricity is the light employed in this case. In starting in the fall, the alarm clock is set to go off at 4:30 a. m. This automatically throws the main switch and lights the pens. Every ten days the hour of lighting is advanced fifteen minutes, until the birds are rising at 3:30 a. m. Morning light alone is used, none being employed in the evening. The lights are switched off at daybreak.

Table 3 shows the egg production monthly from July 1, 1917, to June 30, 1918, inclusive, both percentage and total. The average number of birds each month is likewise included.

Table No. 3

	Pen No. 5 (not lighted)			Pen No. 6 (lighted)		
	No. Hens	No. Eggs		No. Hens	No. Eggs	
July, 1917	485	4412	29%	388	2410	20%
August, 1917	480	3874	26	374	2784	24
September, 1917	478	2971	20	373	3378	30
October, 1917	476	2129	14	373	3330	30
November, 1917	474	1724	12	370	3522	30
December, 1917	468	3918	27	362	3364	30
January, 1918	452	5127	36	337	4100	40
February, 1918	440	5785	47	325	4222	46
March, 1918	430	6801	51	321	4438	44
April, 1918	423	6832	54	312	5797	60
May, 1918	414	5748	45	308	5028	53
June, 1918	406	5020	41	299	4028	45
Total		54341			46401	
Average	452.2	120.2		345.2	134.4	
Mortality		16.3%			23%	

In this case we note also a heavier production in the case of the lighted pen, which averaged 14.2 eggs per hen greater yield for the year. As in the former example, however, the greatest interest lies in relation to the distribution of this production throughout the various months of the year. Table 4 presents the percentages of the total production for the year which occurred during each month.

Table No. 4

	Pen No. 5	Pen No. 6
July, 1917	8.1%	5.2%
August, 1917	7.1	5.9
September, 1917	5.5	7.3
October, 1917	3.9	7.2
November, 1917	3.2	7.6
December, 1917	7.2	7.2
January, 1918	9.4	8.8
February, 1918	10.6	9.1
March, 1918	12.5	9.5
April, 1918	12.5	12.5
May, 1918	10.6	10.8
June, 1918	9.2	8.7

As in table 2, we find that there is a much more uniform distribution of egg production throughout the year in the case of the lighted pen than holds true in the case of the pen carried under normal conditions of light. Using the six winter months, from October to March, inclusive, we find that a total of 46.8% of the eggs for the pen not lighted were produced, while for the lighted pen 49.4% of the entire year's production occurred during this period. This shows a difference of but 2.6% in favor of the lighted pen. While this is not great, it shows an almost perfectly distributed production.

Using the months of October, November and December as those in which the highest egg prices usually obtain, we find a total percentage production of 14.3 for the unlighted pen, while there is a total of 22 for pen No. 6. This difference of 7.7% is one of tremendous importance as one egg produced in this period may easily be worth about as much as two laid during April, May and June. Yet the production of the two pens for the last named period is practically identical. Herein apparently lies the reason why we often find an increase in the annual egg yield of hens subjected to lighting as against those kept under normal conditions, since much of the winter egg production seems to be of a sort of artificially occasioned nature, following which the birds will produce

about as many eggs in the spring and summer following, though, as I have mentioned previously, the normally expected peak of production in April and May may be greatly flattened out, and distributed over an increased span of time. This corresponds quite closely to the distribution of production found in the trap-nest record of a high layer as contrasted with a much inferior one. Both birds may lay about the same number of eggs during the spring and early summer months. The heavy producer passes the lower bird by early fall production by virtue of early maturity and precocious production, and also by heavy winter egg production.

The California poultryman from whose plant the above records were taken is firmly convinced of the value of lighting. This winter he has installed lights in three houses.

Another New York Case

The third example I desire to present is that of the College View Poultry farm, operated by C. H. Palmer of Alfred, N. Y. Two years' data are tabulated herewith. In the year 1916-1917 no lights were used. In the second year, 1917-1918, natural gas lights were used, beginning December 13th, and continuing until March 1, 1918. Table 5 illustrates the average number of birds each month, the number of eggs laid each month, and their selling price for each month during the two consecutive years.

Table No. 5

	Nov. 1, '16, to Oct. 31 Inc., '17;			Nov. 1, '17, to Oct. 31, '18		
	No. Hens	Eggs Laid	Value	No. Hens	Eggs Laid	Value
November	300	388	$ 21.65	300	774	$ 68.30
December	360	885	37.67	375	1129	85.20
January	400	1302	74.86	475	5187	316.90
February	420	1933	89.80	450	6260	260.06
March	460	6456	132.08	430	7848	246.79
April	475	8366	215.54	423	6315	176.12
May	460	8775	270.90	392	6749	211.62
June	430	7180	243.01	346	4757	180.31
July	372	6182	194.65	312	5320	235.28
August	319	4314	224.86	304	3879	184.78
September	235	1214	49.73	300	1450	101.35
October	225	601	18.65	326	992	80.15
Totals		47596	1573.40		50660	2146.86
Average	371	129	4.24	378	134	5.68

Table 6 presents the monthly percentages of production for each of the two successive years.

Table No. 6

	1st Year	2nd Year
November	.8%	1.53%
December	1.8	2.2
January	2.7	10.2
February	4.0	12.3
March	13.5	15.5
April	17.5	12.4
May	18.4	13.3
June	15.0	9.4
July	13.0	10.5
August	9.0	7.6
September	2.5	2.9
October	1.2	2.0

Graph 2 on this page, illustrates the distribution of the egg production through the various months of the two consecutive years. It will be noted that here again we find a more uniform production distribution through the various months in the case of the lighted than for the non-lighted year. The curve for the year 1917-18 shows that the peak was reached in March instead of, as in the previous year, in May. The whole curve shows that the production period has been advanced about two months' time.

In December, January and February of the first year 4120 eggs were gathered, while the receipts for eggs sold were $202.33. In the second year there were a total of 12,576 eggs produced, with a value of $662.16. In the first case the number of birds averaged 393; in the second, 433. This plainly indicates the possibility of getting high averages of production through the use of lights and when egg prices are at their highest limit. So conspicuous has been the success of Mr. Palmer that 15 other poultrymen in the same county (Allegany) are using lights this winter. Electricity is not usually available, consequently the poultrymen are purchasing gasoline mantle lanterns in quantity through the medium of the County Poultry Association.

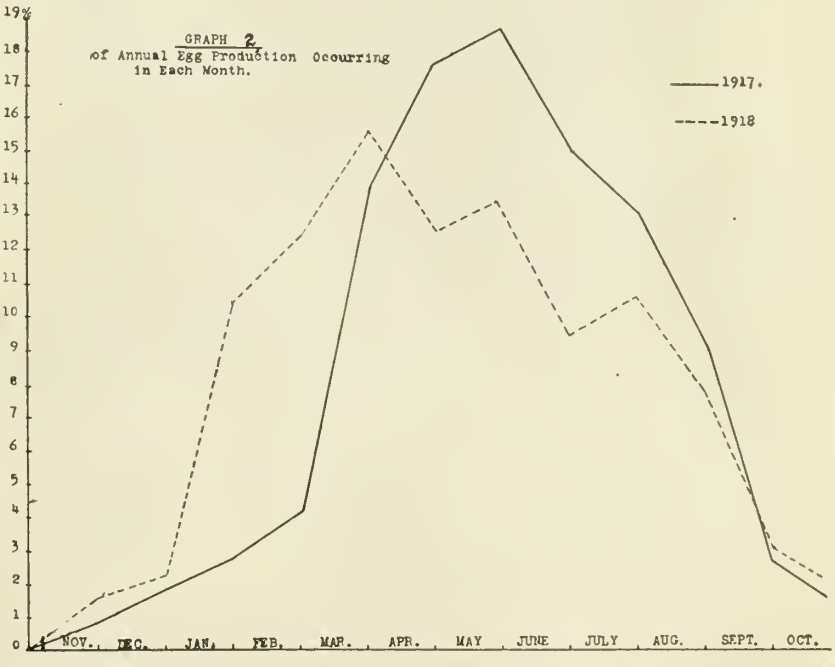
I have previously mentioned the steadying effect of the lights on the egg production of a flock. As illustrative of this fact it may be of interest to study the daily record of production in Mr. Palmer's flock for a four-week period following the time when lighting was begun. These daily egg production figures are tabulated in Table 7.

Table No. 7

December 13, 15	December 23, 33	January 1, 132
December 14, 13	December 24, 36	January 2, 141
December 15, 16	December 25, 42	January 3, 154
December 16, 17	December 26, 54	January 4, 166
December 17, 15	December 27, 71	January 5, 147
December 18, 13	December 28, 80	January 6, 156
December 19, 19	December 29, 96	January 7, 152
December 20, 17	December 30, 112	January 8, 155
December 21, 29	December 31, 122	January 9, 153
December 22, 27		

It will be observed that the lights did not show their effects on egg production until the eighth day after they were started. Beginning on December 22nd, the production was materially increased each day for thirteen consecutive days. This fact becomes one of great significance when one recalls the weather prevailing at that time. Most Leghorn breeders know the detrimental effects of severe cold snaps on egg production. From December 27th to January 2nd, inclusive, in this particular locality, the thermometer did not rise above the zero mark DURING ANY HOUR OF THE DAY OR NIGHT. Yet the production steadily increased. Outside temperatures as low as 32 degrees Fahrenheit were reported within a mile of the plant. The egg production in neighboring flocks dropped with the mercury, in some cases near to the zero mark. With all low temperature records shattered for periods of 35-60 years, Mr. Palmer's detailed records

(Continued on page 45.)



Graph 2—This sketch also shows the effect of using lights. You will note that when lights were supplied the peak of egg production was in March in place of in May and in this case also there was a more uniform production than when no lights were used, which means that the hens produced heavily when eggs were bringing the highest prices. The figures to the left should have appeared also on Graph 1. They indicate the percentage of production.

Influence of Length of Day on the Production of Winter Eggs

IN THE READING MATTER HEREWITH THE AUTHOR TREATS ONLY OF ONE OR TWO FACTORS WHICH CONTRIBUTE TO WINTER EGG PRODUCTION AND DOES IT IN A GENERAL WAY; NEVERTHELESS WHAT IS SET FORTH IS OF IMPORTANCE AND COMMANDING INTEREST TO ALL WHO WISH TO STUDY THIS SUBJECT WITH THE OBJECT OF INCREASING PROFITS TO BE EARNED BY KEEPING DOMESTIC FOWL "FOR BEST RESULTS"

By JAMES E. RICE, Professor of Poultry Husbandry, Cornell University, Ithaca, N. Y.

EDITOR'S EXPLANATION: Accompanying the first article of his series on the use of "Artificial Illumination", now running in these pages (see page 33,) Prof. Luther Banta sent us lantern slides of a chart, "showing the correlation between egg production in Australia and New York State", also two charts which indicate "the influence of outside temperature on the temperature of fowls and egg production." Prof. Banta reported at the time that these lantern slides were made from charts or reproduction of charts, which were in the possession of the Poultry Department at Cornell University.

R. P. J. found it impractical to make legible reproductions, small in size, from these lantern slides or photographs of same, hence wrote to Prof. Rice, head of the Poultry Department at Cornell, and he kindly sent us the originals, from which reproductions were made, as published herewith. True to his earnest nature and efficient methods, Prof. Rice sent us legends or foot-notes descriptive of these charts, for which double service R. P. J. hereby extends its thanks and those of our many readers who are interested in this important subject. Writing under date October 17, Prof. Rice said:

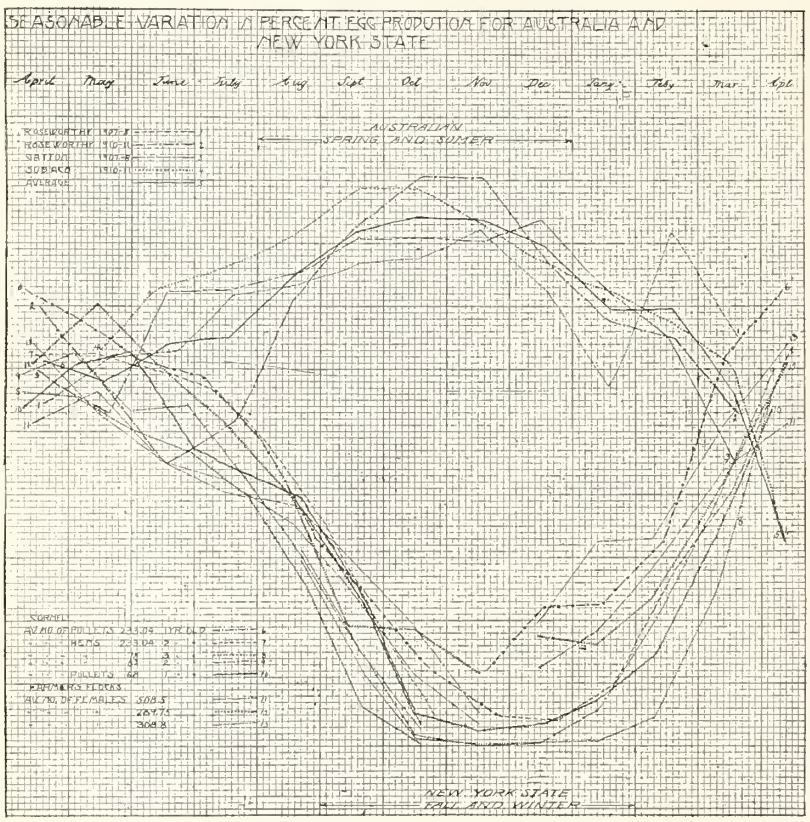


Fig. 1—We are indebted to Prof. James E. Rice for the loan of his original chart and regret that owing to the size of our pages we could not make this reproduction large enough so that the lettering and figures could be easily read. At the top are the words "Seasonable Variation in Per Cent Egg Production for Australia and New York State." The months run consecutively from April to April. The arrows at the top show the "Australian Spring and Summer", from August to December inclusive, while those at the bottom show "New York State Fall and Winter", from September to January inclusive. At the top to the left are the words, "Roseworthy 1907-8—1; Roseworthy 1910-11—2; Gatton 1907-8—3; Subiaco 1910-11—4; average—5." The lines between these words and numbers show the style of lines used in the chart to indicate the egg records made by these flocks. Below, the reading is, "Cornell, Av. No. of pullets 233.04, 1 yr. old—6; Av. No. of hens 233.04, 2 yr. old—7; Av. No. of hens 78, 3 yr. old—8; Av. No. of hens 82, 2 yr. old—9; Av. No. pullets 68, 1 yr. old—10. Farmers' Flocks, Av. No. of females 508.5—11; Av. No. of females 289.75—12; Av. No. of females 308.8—13. At the end of the lines in the chart the outside figures to the left are 6, 2, 13, 7, 12, 9, 8, 10, 11; inside figures 4, 5, 3 and 1. At the right hand side the outside figures are 6, 13, 7, 12, 10, 11, 5 and 4; the inside figures are 1, 9, 2, 3 and 8, though Fig. 8 ends above Fig. 10. A magnifying glass will help interested readers to follow these lines from side to side. Figs. 1 to 5 inclusive represent the records made by the Australian birds, while Figs. 6 to 13 represent the records made by the Cornell birds. The "First Legend" as furnished by Prof. Rice that appears herewith, will make plain the records that appear on this chart.

"I am sending under separate cover a reprint from the Proceedings of the Royal Society of Edinburg, entitled, 'An Investigation Into the Effects of Seasonal Changes On Body Temperature', by Doctor Sutherland Simpson, who conducted quite an extensive temperature experiment in co-operation with the Department of Poultry Husbandry at Cornell in the years 1910-1911. This publication contains a number of illustrations and various data in addition to the material which Mr. Banta sent to you. I am also sending the original and the only copy I have of a chart entitled, 'Seasonable Variation in Percentage Egg Production for Australia and New York State', which I prepared seven years ago to illustrate a vital principle in egg production, namely: the way in which fowls respond to climatic conditions.

"Inasmuch as these illustrations are to appear in a Cornell publication on illumination in the near future, I felt that the matter should be taken up with the Dean before forwarding the illustrations to be used in connection with an article to appear in current literature. Dean Mann has given his consent, with the understanding that mention be made of that fact that these illustrations will appear at an early date in a Cornell publication, giving the results of experiments in illumination as influencing egg production."

In addition to publishing these illustrations and the legends furnished by Prof. Rice—doing so for the purpose of supplementing the down-to-date and reliable information that is being given to our readers by Prof. Banta in the series of articles before referred to, we also publish herewith several interesting and impressive paragraphs from a lantern slide address delivered by Prof. Rice at the Forty-third Annual Convention of the American Poultry Association, Chicago, August 12-15, this year, the sub-

ject of which address was, "The Influence of the War on the Commercial Poultry Industry."—Editor.

First Legend, As Furnished By Prof. Rice

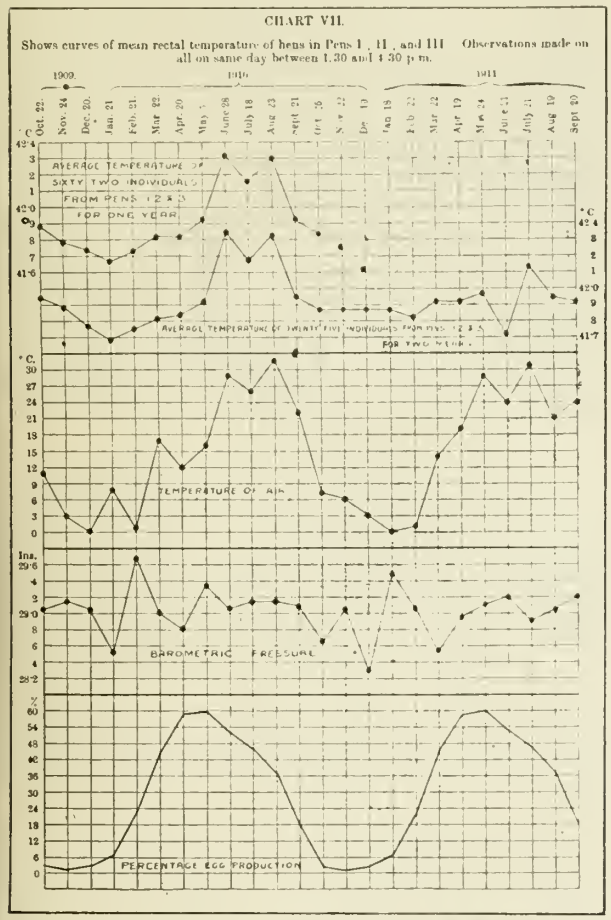
"Legend descriptive of the chart (see Fig. 1 herewith) showing the correlation between egg production in Australia and New York State, prepared by the Department of Poultry Husbandry, Cornell University, Ithaca, N. Y.

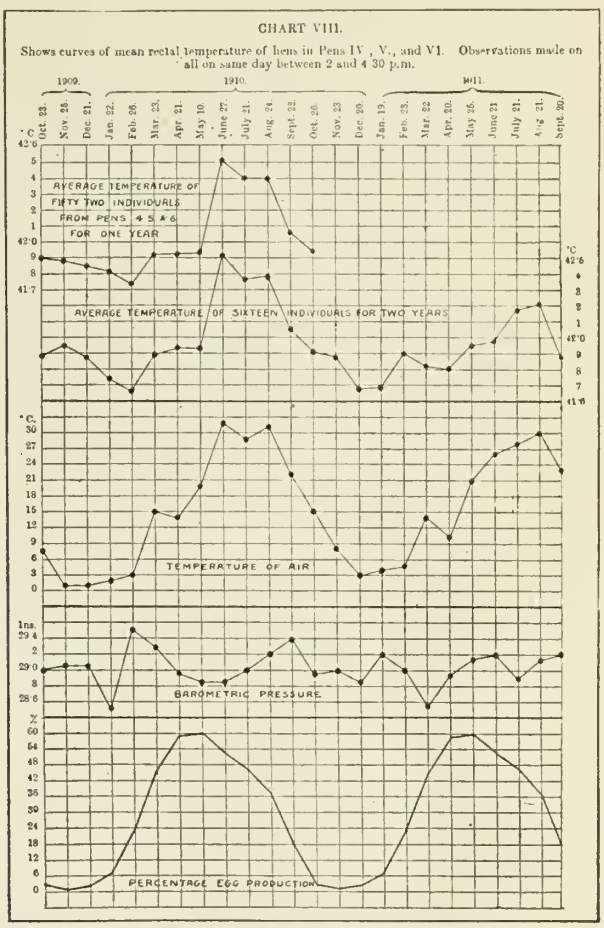
"This chart illustrates a fundamental principle in egg production and in the physiology of the domestic fowl, namely: that hens, like all other animals of the bird family, are exceedingly responsive to their environmental conditions, whether these conditions are climate, which includes temperature, sunshine, humidity, or food. It is upon the fact that the hen responds in her production, both of eggs and flesh, to her environmental conditions that certain physical characters vary during the year, which enables us to select hens according to their productive values.

"The fact that hens do vary in the manner of distributing their egg production throughout the year is clearly shown in the curves of production of eight flocks of fowls at Cornell University, Ithaca, N. Y., in a manner directly opposite to that of fowls kept in Australia. It will be observed that when the five Australian flocks were making their highest production in September, October, November and December, the flocks in New York State were making their lowest production and that in the months of March, April, May and June, when the New York State flocks were making their highest production, the flocks in Australia were producing the least number of eggs.

"It will also be seen that the curve of production of the Australian flocks is flatter, that is to say, that there is less variation from month to month throughout the year than is the case with the flocks in New York State, which may be accounted for by the fact that there is a less variation in the range of climatic conditions in Australia than in New York State.

"As indicating the uniformity with which flocks of different ages and breeds vary in their production in a certain section, it will be observed that there is a general uniformity in the production of the flocks in New York State, although these records were of birds of several different years, different breeds and ages, varying from one to three years. Notwithstanding this fact, the curves have a tendency to follow the same general direction in the same months of the year with but very slight exceptions."





EFFECTS OF SEASONAL CHANGES ON BODY TEMPERATURE

Figs. 2 and 3—In Chart 7 the top black line shows the "Average Temperature of Sixty-two Individuals From Pens 12 and 3 For One Year"; the second line shows the "Average Temperature of Twenty-five Individuals From Pens 12 and 3 for Two Years"; the third line shows the "Temperature of the Air" during the same periods; the fourth line shows the "Barometric Pressure," and the last line the "Percentage of Egg Production". Note how the temperature of the hen's body and her egg production follow the temperature of the air. In Chart 8 the upper line shows the "Average Temperature of Fifty-two Individuals From Pens 4, 5 and 6 for One Year"; the second line the "Average Temperature of Sixteen Individuals for Two Years"; the third line, "Temperature of the Air" during the same periods; the fourth line "Barometric Pressure", and the last line "Percentage of Egg Production." See 'Legend No. 2" by Prof. Rice in the accompanying article.

Legend No. 2, As Furnished By Prof. Rice

"Legend, the influence of outside temperature on the temperature of fowls and egg production.

"From proceedings of the Royal Society of Edinburgh, entitled, 'An Investigation Into the Effects of Seasonal Changes in Body Temperature', by Dr. Sutherland Simpson, in co-operation with the Poultry Department of Cornell University, Ithaca, New York.

"This chart (see Fig. 2 and 3, on this page) shows the marked correlation between the average temperature of

a flock of fowls as compared to the average temperature of the air, the barometric pressure and the number of eggs laid in periods of four weeks for the years 1909, 1910 and 1911. It will be observed that the fowl's temperature has a tendency to vary with wide extremes in the temperature of the air. This indicates that the fowl occupies a position midway between the cold-blooded animals (the reptiles) on one hand, and the comparatively constant, warm-blooded animals (the mammals) on the other hand. In other words, the fowl conforms to her temperature variation somewhat as the hibernating mammals and reptiles. Her temperature has a tendency to conform to weather conditions. This makes her exceedingly susceptible to sudden and marked changes in weather.

"Inasmuch as temperature is very closely correlated with the hours of sunshine each day, an additional factor is introduced, namely, the length of time that fowls are permitted to range for their food, involving exercise and constant supply of food in addition to the influence of temperature. It would appear, from our present knowledge of illumination, that there is very good reason for believing that the regular supply of food at proper intervals to enable the digestive tract to work most efficiently, is of even greater importance than that of temperature.

"In other words, it would appear that the length of time between meals plays a very important part in enabling hens to manufacture eggs. That this is one of the principal influences of illumination is indicated by the fact that fowls appear to lay most freely when, other conditions being similar, they have as many hours of sunlight for activity as they do of darkness for rest, namely, they respond to the favorable spring conditions of March 21st, when the days and nights in the north temperate climate are essentially equal in length, and that they begin to drop off in production very soon after the days commence to be shorter after the 21st of June, and commence, normally, to get ready to lay when the days commence to be longer after the 21st day of December.

"It appears, from the illustrations, that barometric pressure does not appear to be an important factor as influencing production."

Benefits of Artificial Lighting to Increase Winter Egg Production

Following are the paragraphs reprinted from the stenographic report of Prof. Rice's address delivered at Chicago last August, as per the introductory remarks to his article:

"Fortunately, man has discovered a scientific method by which we can, dealing with EXTERNALS, tell a poor bird from a good bird when we see her—can tell whether or not they are laying or whether they are likely to begin soon and we can tell whether, if they are laying, they will soon quit, doing this by the characteristics of their bodies.

"This is brought about and made possible by two facts. First, that the bird is MOST RESPONSIVE of all of the domestic animals TO HER ENVIRONMENTAL CONDITIONS. She responds to light and darkness; she responds to heat and cold; she responds to comfort and various practical conditions so that she either lays or does not lay, very much depending on the time she is hatched, the breeding, and her inherited tendency, plus the environment that surrounds her. She is a creature of circumstances MORE THAN ANY OTHER DOMESTIC ANIMAL WE HAVE, and that is one of the reasons why so many succeed where other people do not succeed, because one person will follow up the details and handle them wisely and the bird RESPONDS TO THOSE CONDITIONS.

"We need, therefore, to consider also the fact that the fowl, in responding to the environment AND INHERITED TENDENCY TO LAY, goes through a certain physical change each week or month of the year, depending on how many eggs she has laid. The more eggs a hen lays, the more she takes out of her body certain substances which have a profound influence upon her weight, upon her plumage, upon her color and upon the texture of her skin and comb and the hardness of her bones which, if a person understands HOW TO READ THE PICTURE OF THE BIRD, if he understands the bird and these characteristics and the philosophy behind it, he is able to pick out a hen that is laying from one that is not and is able to tell a good one from a poor one at certain seasons of the year.

Proof By Test That Longer "Days" Do Help

"Now the first few slides I want to show, deal with this principle, and if the operator will turn on the light I will attempt to give you the proof of one or two of these facts. These slides give us the result of two years' experiment with a large number of hens, where temperature records were taken at very frequent intervals in order TO FIND OUT WHETHER OR NOT THERE WAS ANY CORRELATION BETWEEN THE TEMPERATURE OF A HEN'S BODY, THE TEMPERATURE OF THE WEATHER, THE NUMBER OF EGGS SHE LAID, AND THE NUMBER OF HOURS OF SUNSHINE EACH DAY, and if you will follow up these curves (indicating on screen), you will notice that there is a very striking relationship between this curve of average temperature month by month for a period of two years for this large number of hens, and this curve of temperature of the weather month by month, and this curve of THE NUMBER OF HOURS OF SUNSHINE, and this curve of egg production of several hundred fowls on the College Farm; and you will notice that there is a perfect comparison, a perfect correlation between this curve of HOURS OF SUNSHINE (indicating on screen) with this curve of DECREASE and INCREASE in the number of eggs LAID PER FOWL during those periods. You will notice that striking relationship and that whenever the temperature of the air is very low, the temperature of the body is lower AND THE EGG PRODUCTION IS LOWER and the hours of sunshine are less, and that as the hours of sunshine increase the temperature of the air, EGG PRODUCTION INCREASES and the temperature of the body of the fowl also increases.

More Time to Exercise and to Eat

"The point I want to emphasize is that the bird is responsive to her environment, and it is for us to overcome those adverse conditions if we expect to get the bird to respond. Now, the whole philosophy of causing fowls to lay high percentages of eggs is based on the principle of equalization of the hours of exercise and the time between meals, and it is truly amazing how you can control the production with the same kind of feed and fowls and care and all other environmental conditions, IF YOU WILL DO ONE THING: get the illumination there by artificial means either in the morning or night or both so that you will make the number of hours of exercise and opportunity to eat and sleep IMITATE THE CONDITIONS, as near as you can, when the days are the same length as the nights, or TWELVE HOURS EACH.

"This one fact, when it is properly applied, will enable a person to TURN FAILURE INTO SUCCESS as a commercial poultryman, because he is able to produce eggs when one egg will bring the price of two at the cheaper seasons of the year, and also to increase the number of eggs that a fowl lays during the year, as well as increasing the proportion of eggs that she lays during the periods of high prices.

"Now to see to what extent fowls come into production and go out of production, with climatical conditions, just as crops of strawberries and watermelons come into the market, I am putting upon this screen a curve to show the percentages of egg production each month in the year, of the five flocks of fowls in different parts of Australia, and these birds are the highest producing birds in the egg laying contests in those sections, and comparing that with what takes place in the same months of the year with a very large number of flocks in New York State, and you will see that the lowest egg production in Australia is in the months of April and May, that it begins to go up in June and July and reaches its highest point in September, October and November and begins to go down in December, January, February and March, whereas the production of a large number of flocks representing a thousand or more birds in New York State is at its highest in April and May, goes down to its lowest point in November and December, and comes up to high production by the following March and April, so that you get almost a perfect circle here (indicating on screen), highest on one side of the earth at the same time that it is lowest on the other. It is a matter of simply RESPONDING TO THEIR ENVIRONMENTAL CONDITIONS, due primarily to hours of sunshine and temperature."

(NOTE: The foregoing article is reprinted from the December, 1918, issue of R. P. J.)

FORCING EGG YIELD BY USE OF ARTIFICIAL LIGHT

(Continued from page 18)

until almost 6 p. m. At that time they were averaging 24 per day; within four days they dropped to 19 per day.

While I cannot say positively that it was the result of shortening the day, I feel confident it was, as their feed was not changed in the least and they are all in fine condition.

In reply to your question regarding incubation of the eggs, would say, on February 3rd I sold to my brother, in Randolph, Mass., 300 eggs from this pen. At the end of seven days 54 were tested out as infertile; from the remainder he hatched 132 chicks, or 44 per cent of the total. They are now ten days old and he pronounces them fully as large and vigorous as any he has in his flock of 700 hatched from eggs purchased of four different poultry fanciers, all chicks being of the same breed.

While I think this was a low percentage it was better with my eggs than any of the others. In my case there were two things which I think affected the result somewhat. The three cockerels were purchased from one party and while they were possibly raised together they spent the greater part of the first few days forcibly renewing their acquaintance, which was bad for their beauty and the peace of the flock. After they had been together but ten days I commenced saving eggs to incubate and by the time they were placed in the incubator some of them were 17 days old. Either one or both of these things may possibly have caused the poor hatch. From a second lot of 139, sold February 26th, 20 were tested out as infertile at the end of seven days; the final result of these of course remains to be seen.

It is my intention to hatch some chicks from these eggs in April for myself that I may be able to watch their growth at close range. Yours truly,

W. H. REYNOLDS.

(NOTE: The foregoing article is reprinted from the April, 1911, issue of R. P. J.)

LIGHTING SYSTEM FOR INCREASING EGG PRODUCTION

(Continued from page 26)

the fact that there are twenty-four hours in each day of human reckoning. On the other hand, it has been made clear by numerous experiments, dating back quite a number of years, that if the domestic hen is comfortably housed, is in good health, and is fed the right kinds and quantities of feed she can produce 250 to 300 eggs in 365 consecutive days and also can manufacture two eggs in twenty-four hours, performing this feat repeatedly in a period of one year, or such a matter.

Some two years ago a Swiss named LeBerthonis worked for W. C. Ellison, resident manager of the Cyphers Company Poultry Farm, Elma Center, N. Y., Mr. Julius LeBerthonis was in his native country, Switzerland, at the time the World War started, but left there and came to America by way of Italy. He spent several months in the Leghorn district of Southern Italy and told Mr. Ellison, at the time he worked for him on the Cyphers Company farm, that it was a common thing for ordinary Leghorns in southern Italy TO LAY TWO EGGS PER DAY during the long days of the spring months and early summer; that this was so common an occurence that nothing special is thought of it by the owners of these fowls. At Madison Square Garden Show, the past winter, Mr. LeBerthonis repeated these statements to editor of R. P. J. and later sent us an article in which they are set forth in detail. Article has not been published in these pages because of its length.

Early Experiments of Dr. E. C. Waldorf, Buffalo, N. Y.

In the February, 1915, issue of R. P. J. was published an exceptionally interesting article by Dr. E. C. Waldorf, M. D., Buffalo, N. Y., inventor of the Magic Egg Tester, which has for its object a determination of the hatching value of hen's eggs by recording the density of their contents. Dr. Waldorf's article was entitled, "Ten Eggs Per Week Per Hen and How it Was Done." This article, complete, is republished herewith, beginning on page 19.

(NOTE: The foregoing article is reprinted from the April, 1918, issue of R. P. J.)

MORE EVIDENCE OF EGG-YIELD VALUE OF LIGHTING SYSTEM

(Continued from page 28)

on they jump down into the straw and get busy and then they go to the mash boxes. At the time of installation, the egg production was 12 per cent, which increased in two weeks to 40 per cent and steadily increased to 70 to 80 per cent and it is still holding up at this writing, the latter part of April. The first month's results were a substantial and convincing proof of the efficiency of this system and we then installed it throughout the entire plant with the exception of the breeding house, and in all of them the results were equally satisfactory. My experience, therefore, has not covered a year's work with the lights, but it does cover the winter months and we are entirely satisfied with the results. The birds are in fine condition and are hustling around every morning at 4:00 a. m. We never use the lights in the evening.

"Our home town, Burbank, is quite a poultry center, having some of the largest commercial plants on the Pacific Coast, and the lighting system is in almost universal use. All the poultrymen here testify to its efficiency. The expense of installation and lighting is largely a local proposition. With us, with the present high price of wire and other material used, it costs about $30.00 for one circuit of twelve to fourteen lights and less than $2.00 a month (March) for 'juice' for this one circuit. It does seem that the lighting system ought to be a good thing for the eastern and mid-western poultrymen and we hope to hear reports from those who have used it with success."

(NOTE: The foregoing article is reprinted from the August, 1918, issue of R. P. J.)

USE OF ARTIFICIAL LIGHTING TO INCREASE WINTER EGG YIELD

(Continued from page 41)

of his flock for a 13-year period show that he had greatly exceeded all past records of egg yield.

Table No. 8 shows the highest and lowest number of eggs gathered by Mr. Palmer during any day in December, January or February for the 12 years prior to 1917-18, and for this last year. Succeeding columns give the average numbers of birds kept, the percentage increase which this highest daily production represents over the lowest, and the average per cent of the flock laying in each case.

Table No. 8

	No. Eggs Per Day		Average	Increase in	Per Cent
	High	Low	No. Hens	%	Laying
Average of 12 years.....	45	20	209	225	16
1917-1918	238	13	462	1831	30.5

This table shows that there was a tremendous increase in production, approximating 1606%, over the average of the previous 12 years. This could not be explained, therefore, on the presumption that the tremendous increase in production was due to additional pullets coming into laying.

To point out the rapidity with which the lights increase production when the birds are fully matured, I shall submit the following facts. Within one-eighth mile of Mr. Palmer's plant are located two smaller plants, one operated by a woman, the other by a man. For convenience, we may refer to them as Miss A and Mr. B.

Miss A had a flock of S. C. White Leghorns, consisting of 150 yearling hens and 75 pullets. On January 4, 1918, she gathered two eggs from the entire flock. Due to the protracted cold weather and low egg yield, she decided to try lights. She procured three kerosene barn lanterns and began to use them on January 5th. Exactly four weeks later she gathered 117 eggs in a single day from the same flock.

Mr. B was very skeptical of the lighting proposition. But noting the success of Mr. Palmer and Miss A, he finally decided to make a last endeavor to break even at least with a rapidly increasing feed bill and a practically stationary income sheet. On January 30, 1918, from 215 S. C. White Leghorn hens and pullets he secured 18 eggs. He bought three kerosene lanterns for $2.80. Lighting was begun January 31st. In less than three weeks' time—to be exact, on February 19th, the same flock produced 143 eggs.

(NOTE: The foregoing article is reprinted from the January, 1919, issue of R. P. J.)

Making Artificial Daylight For the Layers in Winter

PRACTICAL DETAILS IN REGARD TO USE OF ARTIFICIAL LIGHT IN POULTRY HOUSES FOR THE PURPOSE OF SECURING INCREASED WINTER EGG PRODUCTION, GIVEN BY A PIONEER IN THIS REMARKABLY SUCCESSFUL, UP-TO-DATE METHOD—AUTHOR TELLS AT WHAT TIME IN THE DAY ARTIFICIAL LIGHT SHOULD BE SUPPLIED AND HOW LONG TO CONTINUE IT—SEVERAL APPLIANCES FOR ILLUMINATING POULTRY HOUSES DESCRIBED AND ILLUSTRATED — THE BAIT THAT BRINGS THE FOWLS FROM THE PERCHES AND KEEPS THEM DOWN UNTIL THE LIGHTS ARE TURNED OUT

By GEORGE R. SHOUP, Poultryman, Western Washington Experiment Station, Puyallup

IN the November issue of this Journal, under the heading "Discovery of Lighting System in Northwest", we quoted from a letter by Mr. and Mrs. George R. Shoup of the Western Washington Experiment Station, in which was given a description of the manner in which Mr. and Mrs. Shoup discovered that the use of artificial light in the poultry house to prolong the short mid-winter days, regularly resulted in increased egg production. In that article it was stated that in an early issue we should quote from different bulletins written by Mr. Shoup regarding his method, the different lighting devices that may be successfully employed and results secured. This we are doing herewith.

This article contains highly valuable information and directly answers a number of questions that are being asked daily by persons who are interested in this truly practical method of increasing winter production. Readers also are urged to read with especial care the excellent article by Professor Luther Banta of the Department of Poultry Husbandry, Massachusetts Agricultural College, on "Use of Artificial Lighting to Increase Winter Egg Yield", on page 969. (See page 33 of this book).

Of especial interest is the concluding part of this article, which deals with the productiveness of extra-early pullets under artificial lighting. The experience of poultry keepers generally is that while such pullets prove to be good layers in late summer, they almost invariably go into a fall molt, which renders them useless as producers again until toward spring. If it should prove possible regularly to bring these molted pullets back to good production in early winter by the use of artificial lighting, as has been done by Mr. Shoup, extra-early hatching may be expected to develop into a most important feature of commercial egg production. The following article, written by Mr. Shoup, is reprinted from several recent Monthly Bulletins issued by the West. Wash. Exp. Station.—Ed.

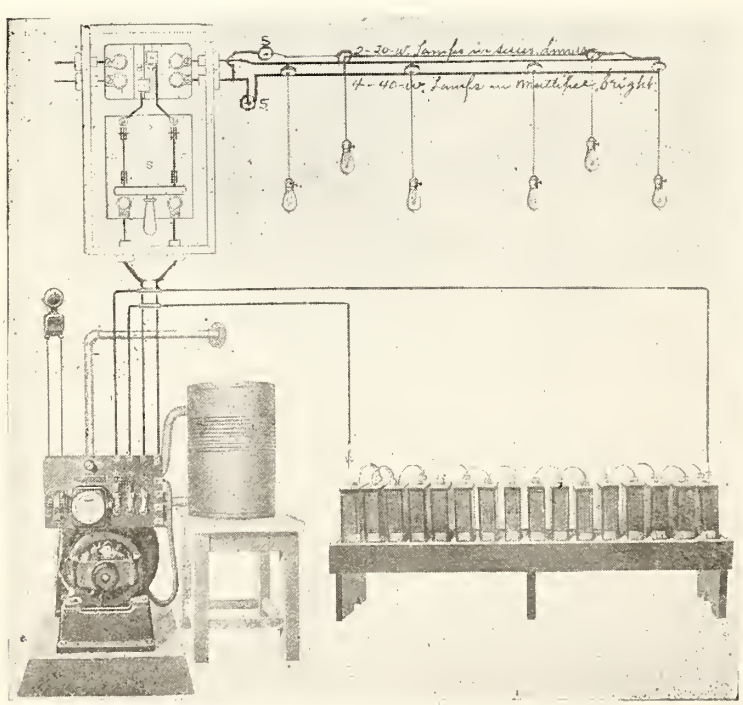


Fig. 1—Diagram of electric wiring for poultry houses. The bright and dim light circuits have separate feed wires, but they use the same return wire. Bright lights are spaced 15 feet apart, are two feet from the front wall or curtain, and are about 5 feet from the floor. Dim lights of about 7-candlepower are placed at about 25-foot intervals and may be on brackets on the front wall supports. The dim lights are used to induce birds to go to roost.

THERE has been considerable discussion among poultrymen regarding the possible overproduction of winter eggs if all poultrymen practice the lighting of their flocks. The bogy of overproduction of high-priced eggs has been heard for years, but every year the price has advanced over the preceding one and the ability of the public to continue to consume the increased output has always kept ahead of the supply.

There is no doubt that, were winter conditions in all parts of the country as favorable for egg production as on the Pacific Coast, the use of artificial daylight would increase the present 10 per cent average winter yield throughout the country to approximate spring production. Fortunately for the Coast poultry business, the severe weather in other localities, the consequent lack of succulent green feed and the extreme difficulty of keeping birds comfortable, will always discourage attempts at high winter production of eggs.

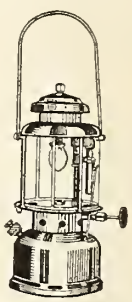


Figure 2 — This small gasoline mantle lantern is easier to carry than the large lantern. It has the same lighting power, but requires more time to operate, because of the daily filling and pumping up.

Another factor is the poultryman who has gone into the business as an easy way to make a living. He is very much opposed to getting up early in the morning and to working with poultry after dark. He always prides himself on the few hours he has to spend with the chickens. "This thing of cleaning the droppings boards every morning and renewing the litter frequently is all bosh", he says. There are many of this type who will never go to the extra work of using artificial daylight. The egg production from their poultry is probably not much greater than that of the average farm flock.

The transportation facilities are much improved in recent years. As an instance, during January and February, 1918, many carloads of fresh Washington eggs, mainly produced by plants using artificial light, left Seattle for New York City at the highest net prices to the producer ever experienced up to that time.

In using artificial light for poultry, the caretaker should clearly understand the function of these extra hours of light. The light is not used as a means of forcing the birds to lay unnaturally. There should be no stimulation such as is derived from condiments or a too liberal supply of green cut bone. Production carried past the bird's ability to renew the

wear and tear on her digestive organs, we believe would be rightly termed "forcing."

An instance brought to our notice recently was an experiment in lighting carried on by a well-known Experiment Station. The endeavor there, as expressed in the report, was to "fool the birds." They were lighted at various hours, starting at 4:00 a. m. and finishing at 1:00 a. m. The report as tabulated showed a very good production for the first few weeks, but later on the birds all went into a molt, and as a consequence the Station officially announced that artificial lighting is a mistake.

The whole endeavor in campaigning for winter eggs should be based on the attempt to produce, as nearly as possible, springtime conditions. These are:

(1) Succulent, tender green feed; a plentiful supply of worms and bugs; warm, soft earth to dust in.

(2) Mild weather conditions; no severe storms or cold to combat.

(3) At least 14 hours of daylight in which to eat and digest food.

The first condition is produced by feeding kale, which usually stays green all winter in this climate, for green feed. The equivalent of the worms and bugs is supplied by feeding fish meal, beef scraps, fresh blood and milk. An inside dust bath where the sunshine strikes, supplies the soft earth.

The second requirement is met by a properly constructed and ventilated laying house with a good muslin curtain in front.

The third essential, light, can be supplied by several different equipments. Whatever equipment is used it is necessary to use a very small and dull light to put the birds to roost after the brighter lights are turned out.

Electric Lighting

There is no doubt that the electric light is the most convenient and safest method of lighting poultry houses. The cost in some instances is considerably greater than where other systems are used, but in no case is it very great considering the benefit that may be derived. In fact, one extra egg a day will pay for the lighting of 100 birds. This Station has demonstrated in carefully conducted experiments that the use of lights in conjunction with other specified ideal conditions will increase production from 30 eggs per day without lights to 60 with lights, per 100 birds.

Electric lights should be spaced about 15 feet apart through the entire length of the laying house. They should be placed well towards the front of the house to permit the light to cover all the floor under the droppings boards, otherwise many birds will stay in the shadow there and sleep instead of working while the lights are shining. In a house 20 feet wide we recommend the 50-watt nitrogen lights for best results.

Many poultrymen who have finally arrived at the stage where their plant brings in a good revenue are now installing home electric light plants. These plants have been developed until they are practically foolproof. They have the advantage over other lights of greater safety and convenience, also ability to light all the buildings as well as the residence and yard from one plant. The cost of these plants at this time, not including the wiring, is upwards of $500.00.

Gasoline Mantle Lights

The gasoline mantle light is one of enormous candle power and has been used very largely on the Pacific Coast for lighting poultry houses. The cost of lighting is said to compare with a rate of 1½c per kilowatt hour for electricity.

For a house 30 feet long or less, the individual lanterns are the best to use. A 50-foot house needs two lanterns, while a house 100 feet long or over had best be lighted with the tube system. In the tube system the gas is all generated at one place and five parts of gas are mixed with 95 parts of air, the air being carried into the generator by a conductor pipe from outdoors. This is the principal advantage this system has over the lanterns or the hollow copper wire system.

The lanterns and hollow wire systems are fed the 95 parts of air directly from the coop. This air is always full of dust, which eventually will clog the gauze strainers of either of them, and a dull light is the result. One drawback to the tube system is the condensation of the gas back to gasoline in the large conveyer pipe whenever a draft of cold air strikes the pipe. In warm heated buildings, such as stores or churches, there is little difficulty of this kind, but in the poultry house it is advisable to insulate the pipes with a heavy paper covering, and all plants should be installed with a T-trap to catch the condensed gasoline before it gets back to the generator and spoils the mixture. Too rich a mixture makes the lights burn red and eventually blackens the mantles. There are no small tip-cleaning wires to get out of order in this system, as in the lanterns and hollow-wire systems, and the lights require no mica shades or glass globes around them. The cost of the tube system varies according to the size. A four-light system for lighting a 100-foot house costs about $60.00 at the present time. Systems can be procured handling 20 or more lights, but the hot gas vapor cannot be carried satisfactorily from one building to another through the cold air outside.

Ordinary Kerosene Lanterns

We have often suggested to the prospective user of artificial lights for poultry, if he is at all skeptical as to the benefit to be derived, that he hang up a few kerosene

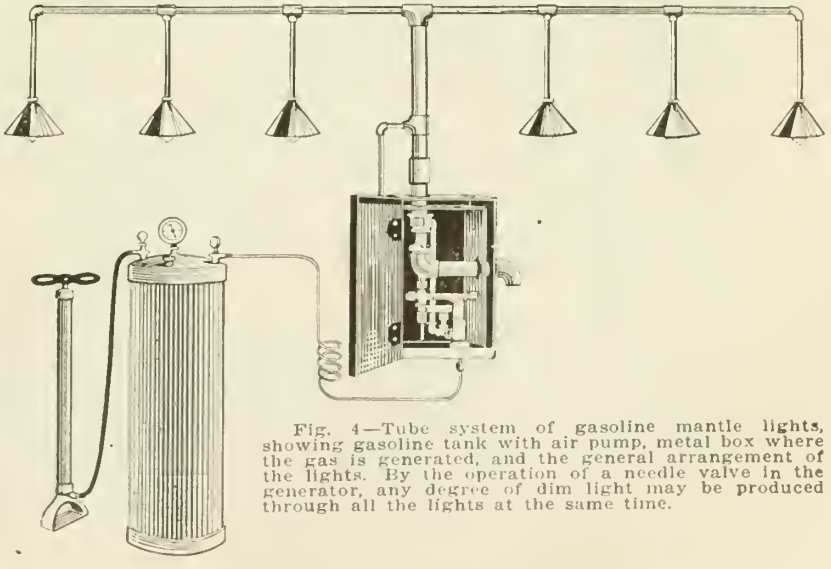


Fig. 4—Tube system of gasoline mantle lights, showing gasoline tank with air pump, metal box where the gas is generated, and the general arrangement of the lights. By the operation of a needle valve in the generator, any degree of dim light may be produced through all the lights at the same time.

lanterns in some of his smaller coops. The ordinary kerosene lantern will stand only one year of the constant service demanded in coop lighting. We do not recommend this plan because of the comparatively small amount of light given, and the large number of lanterns required for a commercial plant. The service is very inefficient, and as the lanterns have to be cleaned and refilled every day, the time required for keeping them in shape is greater than with any other system. The fuel cost is also greater. At one time the writer cleaned the globes, trimmed the wicks and filled the bowls of some thirty-one lanterns every day. The same lighting service was secured the next year with only six gasoline lanterns, and there was a great saving of time and fuel in the operation of the latter.

The writer has had ten years' continuous experience in using artificial light for poultry. Beginning with kerosene lanterns, he changed to gasoline lanterns as soon as he became acquainted with this improved light, later used a hollow wire gasoline system, then a tube gasoline system, and finally a home electric plant. He can confidently assure poultry raisers in Western Washington that the judicious use of artificial light, in conjunction with proper housing and feed, will prove profitable through increased production, and will not in any wise injure the birds or reduce their vitality.

Feeding the Artificially Lighted Flock

Where artificial lighting is regularly practiced, the feeding method recommended by this Station for Leghorn pullets laying heavily, based on units of 100 birds, is as follows:

7:00 a. m.—8 lbs. of dry oats, germinated to very short sprouts.

3:30 p. m.—8 lbs. scratch grain.

5:00 p. m.—4 lbs. of a good dry mash mixture wet with water, to which fresh blood is added in proportion of 1 pint of blood to 1 gallon of water. In the absence of blood, 4 quarts of sour milk or buttermilk may be used, or blood meal, at the rate of about 10 per cent of the mash fed, mixing this with a suitable quantity of water.

7:30 p. m.—Kale.

Dry mash is supplied in hoppers, and during the day one hundred birds will average to consume about four pounds of this, also about a gallon of clabbered milk, which is fed about 9:00 a. m. The kale, which is fed at 7:30, is greatly liked by the fowls, and when brought in after supper proves to be a good bait to bring the pullets off the roosts, where many of them go after filling up on the mash. Without a bait of some kind they will turn their backs to the brightest lights and the attempt at lighting will be a failure. After a few weeks of this practice the pullets refrain from roosting early and most of them are on the floor waiting when the kale comes in. After eating the kale they scratch industriously for grain in the litter, eat more dry mash, water and shell, and by 8:30 or 9:00 p. m. are filled to repletion again.

Our feeding trials have shown no difference in production if the day starts at 5:00 or at 7:00 a. m., providing a 14-hour feeding period is given. One advantage of the later start is the shorter period before the sun has warmed the atmosphere in the coop, eliminating the danger of the water freezing in the drinking vessels.

The pullets must never be allowed to drink water with ice in it, or to eat frozen kale or mangles, as they are certain to get bowel trouble and quit laying. If the kale is frozen when the lights are turned on, it should be hung up in the wire front out of reach of the birds until it is thawed out. Enough kale should be fed each night to last till noon the next day. If any is left at that time it is removed from the coop until 7:30 p. m. Neglect in removing the frozen kale and in thawing out the drinking water is usually occasioned by the caretaker having the electric light button over the head of his bed, and when the birds go into a partial molt it is unjustly blamed to artificial lighting. The cause probably was the method of handling the lights.

Artificial lighting can be overdone. The benefit derived from the lights is immediately apparent to the caretaker, and as the price of eggs is always highest during the short-day period, the temptation is very great to drive the birds past their limit of laying. The skillfull operator keeps careful note of the condition of his birds. If the flesh on the keel bone is gradually receding and the birds losing weight, there is a day of reckoning coming and he will most certainly go through a six-week period of greatly reduced production.

Fig. 3—Large gasoline mantle lantern specially designed for lighting poultry houses. One filling with gasoline lasts about a week, and more air pressure is added each day without losing the pressure already in the tank as in the smaller lantern which has to be filled every day and the air released in the process.

Experience has shown that with the day regulated by artificial light to 14 hours, and with the right kind of feeding, the pullets can be kept in good condition and will continue laying regularly at the rate of about 60 eggs per 100 birds. It is much better to let them jog along at this rate, keeping them healthy, busy and happy, rather than to try to force them beyond this practical, safe limit.

If they lag, examine the litter for an ammonia odor, indicating that it should be changed; see that ice is not left in the water bucket, nor frozen feed where the birds can get it. If they run up to 75 eggs a day, increase the green feed and cut down on the morning oats and evening grain until they come back close to 60. That is their best gait at this season under all ordinary conditions.

Artificial Lighting For Early-Hatched Pullets

The question of the right time to hatch is a momentous one. On it may depend the success or failure of next season's egg crop. There is a very general belief that early hatches, especially January and February hatches, are unprofitable because the pullets molt in the fall at the time of highest egg prices. March, April and May are the months when most hatching is done. Eggs are then most plentiful and cheapest, and this is the time of the year when the hens are out on the succulent spring range and the fertility of the eggs is highest.

Experiments carried on at this Station for the past three seasons go to show that early hatches pay best, and the earlier the better. To illustrate, in 1917 one hundred and sixty pullets hatched from January eggs have shown a very remarkable egg production. They started laying June 10 and by August 1 were in full laying. A few started the pullet molt in August, but there has never

been more than 21 per cent of them molting at one time. The average length of time for this pullet molt was 47 days; about half the time required for the old hens. The production has never gone under 45 per cent since August 1, and they have gone through the entire high-priced egg period since the middle of October with production between 60 and 70 per cent.

These birds after molting are fully matured and lay a beautiful hatching egg. They have been mated to vigorous cock birds and the hatching results thus far (November 28 and December 3) have been quite satisfactory, averaging 61 per cent of eggs set, with 10 per cent mortality of chicks up to the fourteenth day of brooding. We thus have a certainty of more early-hatched chicks for next season's flock.

Thus far these February pullets have been handled solely with a view to market eggs. They have had the artificial light and the blood mash after the evening grain feed, as described. The weather conditions have been exceptionally fine thus far. The birds are still in very good condition and have had almost no ailments. Only two have died, and two have been marketed as culls. Many of these birds have now (December 18) laid over 150 eggs, and the flock will average 50 eggs more than April batch, which, in spite of a reduction of hours of lighting and a reduced ration to retard production, show an average of over 75 per cent for the past 60 days.

The early-hatched pullets referred to above were from the same pen of breeders as the April birds and were produced with the same equipment of incubators and brooders, which would otherwise have stood idle. They cost about 2c more per day-old chick, because of the higher-priced eggs and the lower fertility, but to date they show $1.00 greater profit per bird than do the later hatches.

These early-hatched pullets also serve to equalize the daily egg yield in September and October, when the old birds were quitting. With a January or early February hatch there should never be a period of very slack production, as is to be expected when only March, April and May hatched birds are used. This early hatch should be large enough to pay those October feed bills. Another good reason for these early hatches is the certainty of filling your pullet laying house in the fall. Suppose the April or May hatch goes wrong; it is then too late to run another hatch and too many of the less profitable old birds have to be kept over.

The following statements give a fairly accurate comparison between the February 1st and the April 1st hatches. The flock hatched April first consisted of 320 pullets and the one hatched February first contained 160 pullets. For comparison we have assumed that the market cost of feed has been the same during the laying periods of both hatches. The February 1st lot was hatched by the Poultry Short Course students in four small hatches—January 25, January 29, February 5 and February 13. For convenience in computation we assume all were hatched February 1st. The cost of chicks, brooding and feeding to six months of age for February birds was $1.02 and for the April birds $1 each.

Each bird was banded as she was taken from the trap nest after laying her first egg. It will be noticed that the April birds show a very heavy production in November. In fact, the average production for the six weeks beginning November 1 was 79 per cent. At this writing both the February and April pens are producing about 75 per cent, and we are gradually curtailing the production by increasing the bulky feeds and the carbohydrates at the expense of the protein.

Record of Flock Hatched February 1st

Month	Birds Banded	Number Molting	Yield
June	19	None	90 eggs
July	60	None	845 eggs
August	125	12	2,426 eggs
September	150	21	2,776 eggs
October	160	34	2,227 eggs
November	160	3	3,272 eggs

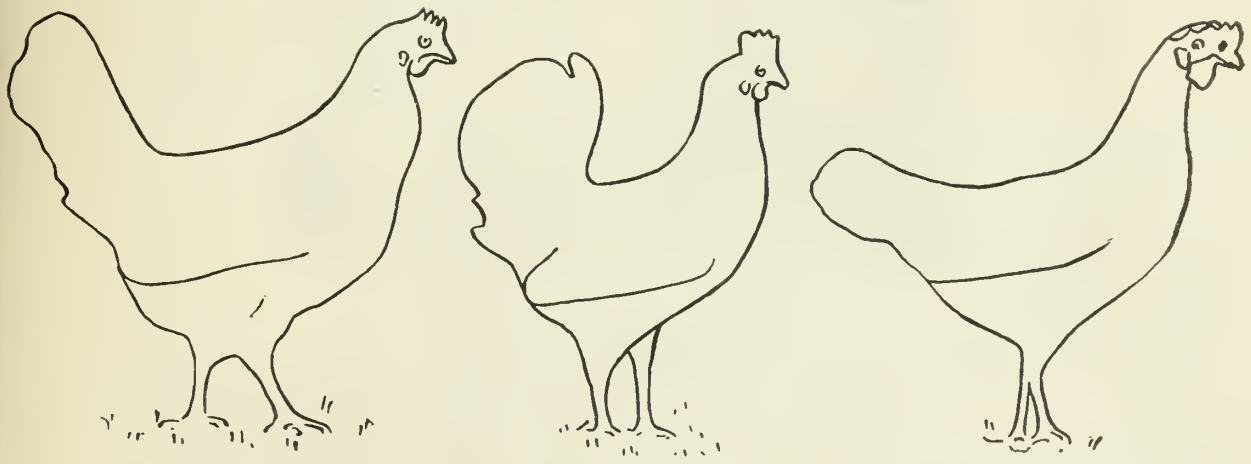
Gross returns to December 1	$455.26
Cost of feeding 160 pullets from August 1 (when 6 months old) to December 1, at $.009 per day per bird	175.68
Net profit on February 1st pullets to December 1st	279.58
Profit per bird to December 1	1.747

Record of Flock Hatched April 1st

Month	Birds Banded	Number Molting	Yield
September	16	None	85 eggs
October	200	3	1,996 eggs
November	320	1	7,491 eggs

Gross returns to December 1	$413.08
Cost of feeding 320 six-months-old pullets to December 1st at $.009 per day per bird	175.68
Net profit on April 1st pullets to December 1st	237.40
Profit per bird to December 1	0.74

(NOTE: The foregoing article is reprinted from the January, 1919, issue of R. P. J.)



A 54 egg hen A 76 egg hen A 203 egg hen

OUTLINES PREPARED (OFFICIAL) TO SHOW TYPES OF GOOD AND POOR LAYING LEGHORN HENS

At the Second Annual Judging and Breeding School, New York State College of Agriculture, Cornell University, Ithaca, N. Y., July 7-12, 1919, a representative gathering of the officers and members of the American Association of Instructors and Investigators in Poultry Husbandry adopted a new section for the Official Outline to judge and cull layer-flocks for egg production, entitled "Body Capacity", as recommended by Dr. O. B. Kent of the Poultry Department at Cornell, and later Dr. Kent sent out for general use the above shape outlines. These outlines are reproduced from R. P. J.'s new and profusely illustrated book, "Profitable Culling and Selective Flock Breeding." The object of the three pictures is to show the relation between body capacity (type) and egg productiveness. Hen in center is hopeless as a profitable layer, because seriously lacking in capacity. Hen on the right has both capacity and quality—and a good record follows naturally. The truly successful poultry keeper must know how to cull his flocks so that he will have very few of the first and second types, and as many of the last as possible. "Profitable Culling and Selective Flock Breeding" gives complete, down-to-date information on every practical phase of this important subject.

Artificial Lighting of Pacific Coast Poultry Houses

REPORTS FROM TWO OF THE MANY FAR-WESTERN POULTRY KEEPERS WHO HAVE FOUND THAT THE WISE USE OF ARTIFICIAL LIGHTS IN THEIR LAYING HOUSES BRINGS PROFITABLE RETURNS IN THE WINTER MONTHS WHEN BIRDS NORMALLY LAY FEW EGGS — HOW TO DIM THE LIGHTS AND SEND THE BIRDS TO ROOST — WHAT AND WHEN TO FEED BIRDS CONFINED IN ARTIFICIALLY LIGHTED PENS

By MRS. JEAN A. PATTERSON, Richmond Highlands, Wash., and MR. HARRY BEERNINK, Lynden, Wash.

SOMETIME ago, at our request, Mr. George Shoup, poultryman Western Washington Experiment Station, Puyallup, kindly gave us the names of a few persons who were using artificial lights in their poultry houses, and we wrote to several of them, asking them to tell R. P. J. readers their experience in prolonging the winter days for their poultry. We are publishing herewith the replies received from Mrs. Jean A. Patterson and Mr. Harry Beernink. Mrs. Patterson wrote as follows:

"We do not use lights in the houses containing our breeding birds, but only in the pullet house, which is 120 feet long by 20 feet wide. In it we use six 40-watt lights.

"According to Mr. Shoup's method, which we follow, the wet mash should be fed at 5:30 p. m. and the kale should not be brought in until 7:30. On account of our inability to obtain hired help, which leaves my sister and myself to attend the fowls, we changed the Shoup method and feed the wet mash just at dusk, so that the birds can see to eat the mash from the trough, which is on the outside of the building, before the lights are turned on. We have found that each bird stands a better chance to get a few bites of the mash if fed just before dark. At this time of the year it is dark shortly after five o'clock.

"At 5:30 we bring in the kale and feel repaid for our extra work when we see the happiness of our 600 beautiful pullets, their snow-white plumage and scarlet combs against the green of the kale, making a beautiful picture.

"When the majority of them have eaten all they desire and are flying to their perches, we think it is time to turn on the dimmers, which we leave on until all are settled—usually about six o'clock.

"In this way we give the hens a twelve-hour day. We know of others who burn the lights until after 8 o'clock, but what is the use if most of the hens have gone to roost? It seems to me a waste of electric light. Personally, I cannot imagine what the chicken business would be like without artificial lights as we have used them since we began keeping poultry."

MR. GEORGE R. SHOUP

MRS. GEORGE R. SHOUP

PIONEERS IN THE USE OF ELECTRIC LIGHTS IN POULTRY HOUSES

Mr. and Mrs. George R. Shoup are earnest workers in the cause of more and better poultry and probably were the originators of "comprehensive poultry coop lighting." Certain it is that they introduced this method of obtaining winter eggs on the Pacific Coast, and now thousands of poultrymen there are profiting by using their method of lighting the houses and feeding the birds. Mr. Shoup is "poultryman" at the Western Washington Experiment Station, Puyallup, and Mrs. Shoup is "poultry expert" there. See article by Mr. Shoup herewith, also further details of his method of lighting and feeding given by Mrs. Patterson and Mr. Beernink in the accompanying article.

Upon receipt of this letter from Mrs. Patterson we wrote asking for further information in regard to the "dimmers" she mentioned, and in due course received a letter saying:

"In order to be absolutely authentic in regard to the 'dimmer' system used at the Kinmont White Leghorn Farm, I asked a friend of mine, who is an authority on electricity, for some help and he has kindly prepared the following article which I hope will be of assistance to others."

Electrical "Dimmers" For Poultry Houses

In answer to your request for information on electric light dimmers, the following may be of interest:

There are several ways in which electric lamps can be dimmed. The electric current used in suburban places practically all over the United States is known as alternating current, sixty-cycle. A sixty-cycle current is one which travels backward and forward in the circuit regularly sixty times each way per second. In the central parts of some cities, the current is direct, that is, it flows always in the same direction.

In the case of direct current, the only practical way to dim lamps would be by the us of a resistance placed in the lamp circuit. This system is also applicable to alternating current circuits and in addition another system can be used which requires the use of an auto-transformer, being a simple coil wound on an iron core. The first system is shown in figure one. This is the simplest system and can be arranged by anyone of average ability. See Fig. 1. "A" shows the ordinary lamps of the circuit in the poultry houses: "B" shows the resistance inserted for dimming; "C" and "D" are the lighting mains from the company's service; "E" and "F" are the lighting circuit to the poultry houses and "K" is the fuse block which accompanies every properly constructed lighting circuit, the fuse blowing in case of a short circuit or trouble on the lighting circuit. This fuse block is a prevention for fire and should be placed close to the meter.

The simplest form is where there is only one lamp at "A" and where the resistance at "B" consists of a single lamp also. It is plain that the current must pass through both "B" and "A". A switch shown at "H" is connected around the lamp or lamps at "B". When this switch is in, the current passes by it, leaving the lamp at "B" dark and lighting the lamps at "A" to full brilliancy. When the switch at "H" is pulled, the lamps at "A" are dimmed because the current must now pass through "B" also. If "A" and "B" are single lamps equal in size, or a number of lamps equal in size, or if the wattage marked on the lamps at "A" aggregate the same as the wattage marked on the lamps at "B", the current will divide equally between the two and both "A" and "B" will be dimmed to half brilliancy. For instance, if there is a 40 and a 60-watt lamp at "A" and a single 100-watt lamp at "B" the

resistance of the two will be the same in the aggregate and they will be at half brilliancy. If, now, another lamp is added at "B", it offers a new path for the current and all lamps at "B" will fall in brilliancy while the lamps at "A" will rise in brilliancy. If the lamps are unscrewed from their sockets one by one at "B," the lamps at "A" will grow dimmer at each step. The lamps may be unscrewed in this way or small switches may be arranged. All that the whole arrangement then needs is several lamp receptacles and several lamps and the switch "H." Switch "H"

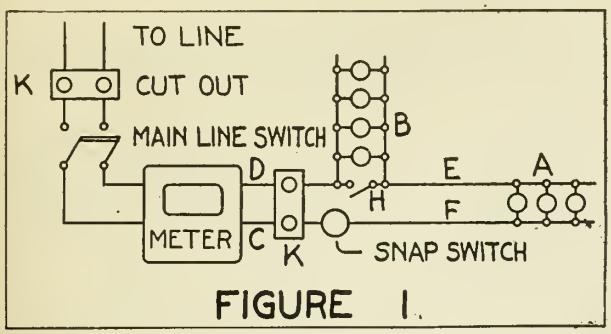


FIGURE 1.

The drawing above represents "the basic idea in dimming (electric lights) for any purpose." This drawing and Fig. 2 were furnished by an electrician to illustrate methods of dimming electric lights in poultry houses so that the birds will go to roost in the artificial "twilight" thus produced. For description see article herewith. Nature sends birds (including our domestic fowls) "to bed" while it is yet light enough for them to see to settle themselves comfortably for the night. If the brilliantly lighted pen were suddenly plunged in darkness by turning out the lights. the birds would be frightened, could not find their way to the proper roosts and undoubtedly the egg yield would show the effects, hence the necessity for producing artificial twilight as well as artificial daylight.

is required on normal operation in order that no current be wasted unnecessarily through lamps at "B" as the dimmer is only used for a short time.

Figure 1 represents the basic idea in dimmers for any purpose. For greater convenience and neatness, since the lamps at "B" are usually placed in the home and the dimmer is operated from there, another method may be used on alternating current. Since almost all circuits are supplied at 60 cycle and 110 volts, the apparatus shown in Fig. 2 is computed for this particular kind of current. It allows, however, of a considerable variation of voltage, the only difference between it and Fig. 1 being that no lamps are used at "B", this being replaced by an autotransformer or resistance coil. This coil may be wound on the center of a mailing tube about one foot long. An iron core, also about one foot long, is slid backward and forward inside this coil to produce the dimming effect. It is totally withdrawn during normal operation of the lamps and does not then appreciably affect their brilliancy. As it is inserted, however, into the tube, the lamps are gradually dimmed until when it is totally inserted, the lamps have gone out. Withdrawing the core gradually raises the lamps to full brilliancy.

The core should be made of the sheet iron used by any electrical house for the repair of transformers, but if this is not available, it can be made from ordinary stovepipe iron cut on a square shears by a tinsmith and the plates piled up and riveted together or simply bound with tape. The core is most conveniently made square, but it is not difficult to vary the width of the sheets so as to make an approximation to a round core which, of course, fits the mailing tube better. It should be loose enough to slide in and out easily. If it is merely taped together, it should be bound tight to prevent any noise from vibration.

The writer will be glad to give any special design in answer to any letter but the layman can easily make up a dimmer from the following information: For the particular current named above, the square inches cross section of the core multiplied by the number of turns of wire equals 800. The most convenient size of core would be a round one, as it fits into a smaller tube. A square core 1½ in. by 1½ in. gives 2¼ square inches area and dividing this into 800 gives 355 turns of wire to wind on the tube. If the core were 2 in. by 2 in., or 4 square inches, it would only require 200 turns.

This design is so far entirely independent of the number of lamps to be used as this is taken care of entirely by the size of wire, that is, the more lamps or the greater their size, the larger will be the wire required. The size of core and number of turns may be varied as desired, but 1½ in. to 2 in. square or the same area of round core 12 inches long will be found to be economical and neat in appearance, the larger core being preferable. The wire is preferably bunched together in the center of the tube and

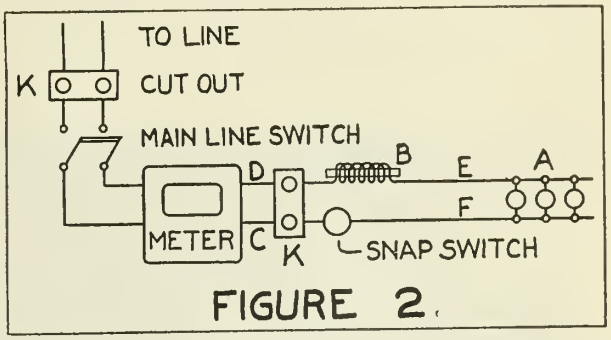


FIGURE 2.

This apparatus is designed to be used with a current of 110 volts. The difference between this method of "dimming" the electric lights and that shown in Fig. 1 is carefully explained on this page.

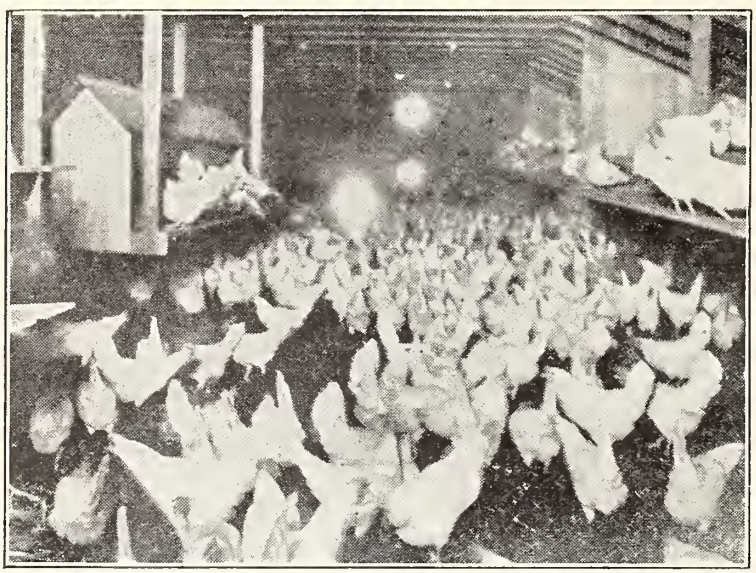
may be wound between cardboard disks glued to the tube. These can be placed about 3 or 4 inches apart. The wire is wound by hand and successive layers are best separated by a layer of paper.

In choosing a size of wire, every electrician or every commercial house selling cotton-covered magnet wire has a set of tables giving the sizes in commercial use in Brown

A flashlight picture of the interior of the pullet laying-house belonging to Mrs. Jean Patterson, Richmond Highlands, Wash., who has found the use of electric lights in the laying house decidedly profitable. She does not use them in the house containing her breeding pens. For her method of "dimming" the lights to allow the birds to find their way to roost, see accompanying article.

and Sharpe's gauge. These tables give the area cross section of the wire in circular mills, the unit that is used exactly as the layman speaks of square inches. All lamps are marked as to their capacity in watts and this is shown on the label of each lamp. The sizes most apt to be used would be 25 W. to 100 W. Allow 9 circular mills area of wire for each watt used. Thus ten 50-watt lamps connected to the dimmer would aggregate 500 watts and at 9 circular mills per watt would require a wire of 4,000 circular mills. Looking this up in the wire table, we find that No. 14 is the nearest size. This should preferably be double cotton covered. This wire, properly wound, gives 190 turns per square inch and the spool may be made accordingly.

A dimmer for any number of lamps may be made from the above by merely changing the size of wire. This design is liberal and for half an hour twice the number of lamps may be carried with safety. The heating of the coil is the only limit to capacity. The design is also good for a considerable variation in the cycles or in the voltage, being well adapted for voltages up to 125. It is much easier to construct and much neater than an equivalent number of lamp sockets and lamps used as a resistance, and unlike the lamps, it wastes very little current. It can be placed close to the meter. Any lamp receptacles or



A flock of happy White Leghorns in an artificially lighted house where they pay their owner, Mr. Harry Beernink, Lynden, Wash., a handsome profit in return for his care and the prolongation of their working day by the use of electric lights in their laying house. See accompanying article for description of Mr. Beernink's method of feeding and the excellent results he has obtained.

dimmer coil should always be put in a dry place, preferably with a thin sheet of asbestos pipe between it and any wood.

There are a number of other applications of electricity for the poultry house which anyone with reasonable mechanical skill can construct in a few hours. Temperature can be controlled in air or water closer than by any other combination and at the same time much more conveniently. The possibilities of these in some cases depend on the cost of current. A little study along these lines is well worth the trouble.

Mr. Beernink is "Lighting" 1,000 Pullets

In November Mr. Harry Beernink of Lynden, Wash., in response to an inquiry from us, replied as follows:

"We are now using artificial lights for our fourth winter and are lighting a thousand pullets which have been laying 66 per cent since the middle of October. From this you will readily see what a valuable thing the lights are, considering the present price of eggs.

"I feel absolutely certain that you can increase the October, November, December and January production of March, April and May-hatched pullets 30 per cent by the aid of artificial lights.

"I do not think it advisable, however, to use lights for breeding hens, with the possible exception of about ten days to get them started to laying, then gradually ease off. If lights are used much on breeders (the second year) they will have done their best laying prior to hatching time.

"I can see no harmful effects when using hens as breeders that have been in artificially lighted pens during their pullet year.

"Care must be used not to overdo the lighting, as good birds can be brought up to 80 per cent production for a SHORT TIME, but nature has so ordained matters that if you force Biddy more than she is able to stand, she will go into a false molt for a month or six weeks.

"When birds are held to 60 to 65 per cent production for the winter months there is not much danger of this false molt and there is no reason why they should go below 50 per cent production for the spring and summer, providing the birds have been bred for eggs. To secure this increased egg production it behooves breeders to produce as strong and vigorous pullets as possible.

"Having longer days, it is of course possible to make the birds consume much more feed, and if they have the constitution that can stand up under the heavier feeding, they are bound to produce eggs accordingly.

When to Use Artificial Lights and What to Feed the Birds

"My method of feeding is very nearly the same as that carried on by my friend, Mr. George R. Shoup, of the Western Washington Experiment Station. He is an 'old-timer' in the use of artificial lighting and was the originator of this method out here, so far as I know.

"Even the amateur realizes that if we could reproduce the long, warm, sunshiny days of spring, with its green grass and insect life, during the cold days of winter, Biddy would respond by laying. In the spring and summer she is up at 5:00 a. m. and goes to roost at 8:00 p. m. with a full crop, having done her duty in the production of an egg. In winter she does not get off the roost until seven or eight and goes to roost before four o'clock, having only an eight or nine-hour day in place of fifteen. It follows that she cannot consume as much feed nor produce as many eggs.

"We can overcome the lack of light by using artificial lights and we can imitate the food, the result being an increase in egg production that means a large profit for the poultry keeper.

"We begin using artificial lights by October first and the pullets are housed in roomy, dry, well-lighted, well-ventilated quarters, with six to ten inches of good litter on the floor, which is changed as often as it becomes damp. In this climate we prefer a laying house 20 feet wide, with a 3½ to 4 foot open front, with muslin or ducking curtains and good ventilators in the roof.

"If electricity is available, use it by all means; otherwise use whatever is available, either kerosene or gasoline lamps or lanterns. Just as good results can be obtained, but the latter require more care and attention. The accompanying picture, which was taken at eight o'clock on a December night, shows a 76-foot by 20-foot laying house equipped with five 60-watt lamps, hanging three feet from the floor. The two nearest the camera had to be hung out of the way in taking the picture. If good gasoline lamps with good reflectors are used, four would be sufficient for this size of house. If the interior of the house, including the roof, is thoroughly whitewashed, it will increase the light 15 per cent. It is well to mention that the lighting must be done regularly, because if you use light one morning and fail to do it the next, the result is harmful.

"The lights should be turned off at 8:00 p. m. If you have 100 laying Leghorn pullets, at 5:45 give them about

(Continued on page 57)

Early "Lighting System" Tests in Eastern Territory on Commercial Basis

THOSE REPORTED HERE WERE MADE IN ERIE COUNTY, NEW YORK, IN FALL OF 1916 AND WINTER OF 1916-1917 — USE OF ARTIFICIAL ILLUMINATION HAD BEEN TESTED PREVIOUSLY WITH SURPRISINGLY GOOD RESULTS BY J. P. JORDAN, AT SUNNY CREST POULTRY FARM (NEAR EAST AURORA, ERIE COUNTY, NEW YORK) DURING WINTER OR SPRING OF 1915, PERHAPS BEFORE THAT — CHART NO. 1 AND TABULATED REPORT HERE PUBLISHED WERE SUBMITTED TO ANNUAL MEETING OF POULTRY INSTRUCTORS AND INVESTIGATORS IN 1917 BY R. S. MOSELEY

Report By EDITOR of R. P. J.

WHILE at Sunny Crest Poultry Farm, near East Aurora, N. Y., February 4th, this year, we were particularly interested in facts brought to our attention about the extensive use of artificial illumination in Erie County, N. Y. (East Aurora and Buffalo are located in this county) for increasing winter egg production during the fall and winter months each season when new-laid eggs command the highest market prices year after year and will pay best, provided they can be obtained in sufficient numbers per hen, per hundred head, or per thousand head. In last month's issue of R. P. J., beginning on page 134, we told our readers what Sunny Crest Farm is aiming to produce in the form of S. C. White Leghorns that will yield the largest "net income per bird developed from all sources"; in this issue we are pleased to make a general report of facts given us at Sunny Crest Farm about the use of artificial illumination for increasing winter egg production, not only on this plant but on numerous other poultry plants and ordinary farms (for farm flocks) throughout Erie County.

Herewith is shown a recent likeness of R. S. Moseley, manager of Sunny Crest Poultry Farm and Secretary of the Sunny Crest Farm Company, Inc. Mr. Moseley entered Cornell University in 1906, where he took the full poultry course. Later he served there as an instructor. He began field extension poultry work in 1912 under direction of the University, as part of the States Relations Service, in cooperation with the U. S. Department of Agriculture. What now is known as the Cornell Poultry Project work was started in 1915, under the personal direction of Prof. James E. Rice, head of the Poultry Department of Cornell University, and Mr. Moseley was sent to Erie County to take charge. Asked how Erie County happened to be selected for beginning this important project, Mr. Moseley replied, in substance:

"I believe credit is due Mr. W. L. Markham, County Agricultural Agent for Erie County, a man who always is looking for something new and better. The idea of this project had been in Prof. Rice's mind for some time before 1915. Our first members were composed largely of fanciers and utility men—that is, regular poultrymen, as they might be called; but later general farm flocks were included in the project, and with good success. Practically every farm that started the project work is still in existence and this last winter, 1918-1919, they were operated at full capacity. In numerous instances the use of artificial illumination on these project farms is known to have saved them financially, in the period of high-cost feeds."

Early Test in Erie County

Mr. Moseley first became interested in the lighting system on account of results obtained from its use at Sunny Crest Farm by J. P. Jordan, owner of the Sunny Crest plant. As stated in our report last month, Mr. Jordan is a member of the firm of C. E. Knoeppel & Co., Inc., industrial engineers, New York City, and Sunny Crest Farm was his country home. Mr. Jordan began use of the lighting system in 1915, so Mr. Moseley stated, trying it on a few pens, starting the lights at 5:00 a. m. and keeping them on during the winter days till 8:30 p. m. We do not understand that they were kept on all day, because at that time they had the same electric lighting system now used by them, which turns on the lights automatically by clock work and shuts them off in the same manner, as per the wishes of the operator. At that time Sunny Crest Farm was included among the Cornell Project plants in Erie County and Mr. Jordan told Mr. Moseley that within a month after he first tried the artificial illumination on a few pens the increase was such that he put lights on the entire plant. Said Mr. Moseley, in substance:

"In the winter season of 1915-1916, Sunny Crest Farm, from 2400 S. C. White Leghorn pullets got as high as 1600 eggs in a single day. This result never before had been approached without the use of lights. Here at Sunny Crest we are in a cold latitude. Notwithstanding this, the use of the lights greatly increased the egg yield, and it developed that Sunny Crest, back in 1916 (winter of 1915-1916), got the highest yield from these same fowls in the April following. No, the use of lights does not appear to affect the vigor of the stock. Each year the birds under the lights, both here at Sunny Crest and at other plants in Erie County, are apparently just as well off in June as though they had not been under lights."

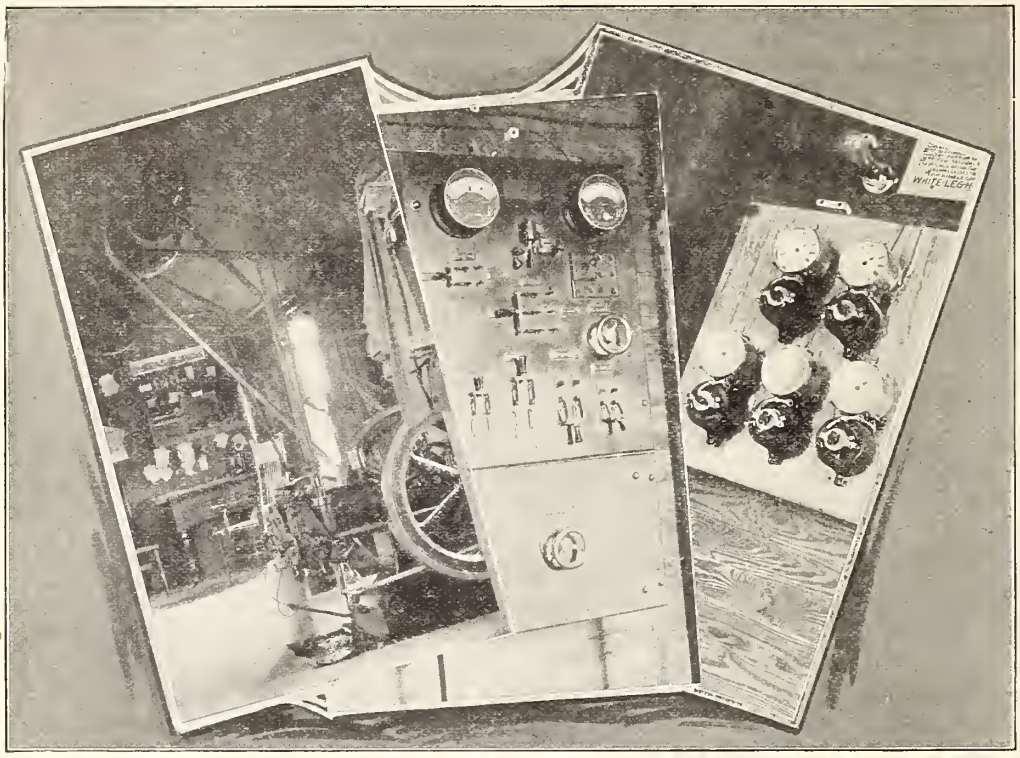
R. S. MOSELEY, East Aurora, N. Y.

Formerly instructor and field project supervisor, Department of Poultry Husbandry, New York State College of Agriculture, Cornell University, Ithaca, N. Y.; now manager of Sunny Crest Poultry Farm, East Aurora, N. Y., and secretary of Sunny Crest Farm, Inc.

In the summer of 1917 (we believe this is correct as to time) Mr. Moseley took two charts with him to the annual meeting of the American Association of Instructors and Investigators in Poultry Husbandry, held in the East—said charts showing the remarkably favorable results of the use of artificial illumination, the contents of which charts are published herewith. Chart No. 1 showed results obtained at Sunny Crest Farm during November 18 to December 16, 1916, and Chart No. 2 (shown in tabulated form, page 55) showed results obtained on the Harry Yates' farm, Erie County, January 10-February 9

inclusive, 1917. See Chart No. 1 on following page.

Referring to Chart No. 1, which gives a record of the egg yield of 875 one, two and three-year old hens from the 18th of November to the 16th of December inclusive, 1916, the row of figures across the top are the days of the months in November and December that are covered by this chart, and the figures at the left-hand side (to be read from the bottom up) represent the percentage of egg yield to the number of fowls, as shown by the actual egg yield that is given in the different squares, following the production line, which line starts with 11 eggs at the low r left-hand corner of the chart, produced November 18th, and finishes with 400 eggs that were gathered from these hens December 16th, as shown in the upper right-hand corner of the chart.



ELECTRIC LIGHTING PLANT AT SUNNY CREST POULTRY FARM, EAST AURORA, N. Y.

In many localities poultry plants can obtain electricity from city or village municipal plants. Where this is impractical an independent plant can be installed at reasonable cost, in the case of large plants that are well equipped otherwise. At Sunny Crest they use electricity for grinding and mixing feed, also for lighting the residence, offices, work-shop, etc.

The daily egg yield is shown by the numbers given in each square on the production line here referred to.

The figures along the bottom of the chart represent: first, from 1 to 11 inclusive, the first 11 days of the experiment, while the figures farther to the right, 1 to 18 inclusive, represent the balance of the period shown on this chart, starting ten days AFTER the lights were turned on (lights were turned on November 19th) and continuing to the end of the period covered by this chart, viz; December 16th.

Effective in About Ten Days

Mr.Moseley stated that as a rule it takes ten days to two weeks (depending partly on the age or condition of the birds, also partly on housing quarters and the state of the weather) for the lighting system to show the hoped-for increased production. This chart sustains that point. It was the eleventh day, in this case, before the incr ased production took place, or on November 29th, as per the chart, on which date 49 eggs were laid, as compared with 20 eggs the day before. Then the increase was rapid—fi om 49 eggs on the 29th to 78 on the 30th; 113 on December 1st; 193 on December 2nd; 260 on December 3rd; 317 on December 4th; and so on up to 456 eggs by December 8th. That was "going some," as the saying is.

But the skeptical reader will say: "Probably those identical hens would have laid just as well at this particular time under the existing conditions, if the lights had not been placed on them, etc." This does not appear to be true, however, as may be learned by a study of the tabulated report, marked Chart No. 2. These two charts, so Mr. Moseley stated, created more or less of a sensation when he presented them at the annual meeting of the Association of Poultry Instructors and Investigators. Those present were skeptical, or at least a large majority of them were—perhaps because it looked too good to be true! And that would be a natural point of view.

Next we come to Chart No. 2, (in tabulated form) which shows a comparison of lights and no lights as applied to birds of the same age, for the same period, under the same conditions and fed and cared for alike, as near as this could be done in practical management. Here 420 pullets were used, one-sixth of the number being put under lights and the remainder being carried along in the normal way on a well-equipped and well-managed poultry plant, which was owned by Harry Yates, a man financially able to "do things right," so to speak. John Casterline, an experienced poultryman, is his superintendent, and had charge of the experiment shown by Chart No. 2 herewith. The work was conducted in such way that Mr. Moseley was kept quite well informed about methods and results, and he vouches for the fairness of this test as to the selection of pullets of apparently equal age, size, health, etc., as representing the 70 that were put under lights, as compared with the 350 that were not.

Chart No. 2 (here presented as a tabulation) is exactly as Mr. Moseley presented it to the meeting of the Association of Poultry Instructors and Investigators, except that we have taken the liberty of adding two columns of percentages, one showing the per cent of the egg yield day by day for the 350 birds and the other showing the same thing for the 70 birds, day by day. As before stated, the 420 birds were housed alike and given the same general care, pains being taken to assure all birds in both lots the same opportunity for production, except that the 70 pullets were placed under lights while the 350 pullets had the benefit of daylight only. Must add, however, that at this writing we do not know whether the 350 pullets were housed together as one flock or were divided into several flocks—perhaps five flocks—70 birds to each flock, although we think that if the 350 birds had been in one flock Mr. Moseley would have mentioned it. It is generally agreed that smaller flocks lay somewhat better than large flocks, under identically the same conditions otherwise. We shall clear up this point for later use in R. P. J.'s forthcoming book on the use of artificial illumination for increasing winter egg production.

(NOTE: Under date October 16, 1919, Mr. Moseley, general manager of Sunny Crest Farm, wrote editor of R. P. J. as follows: "There were 350 pullets in one flock. The 70 pullets had one-sixth as much floor space as was given to the 350 pullets." At this same time (October 16, 1919) Mr. Moseley wrote as follows, with reference to the table here-

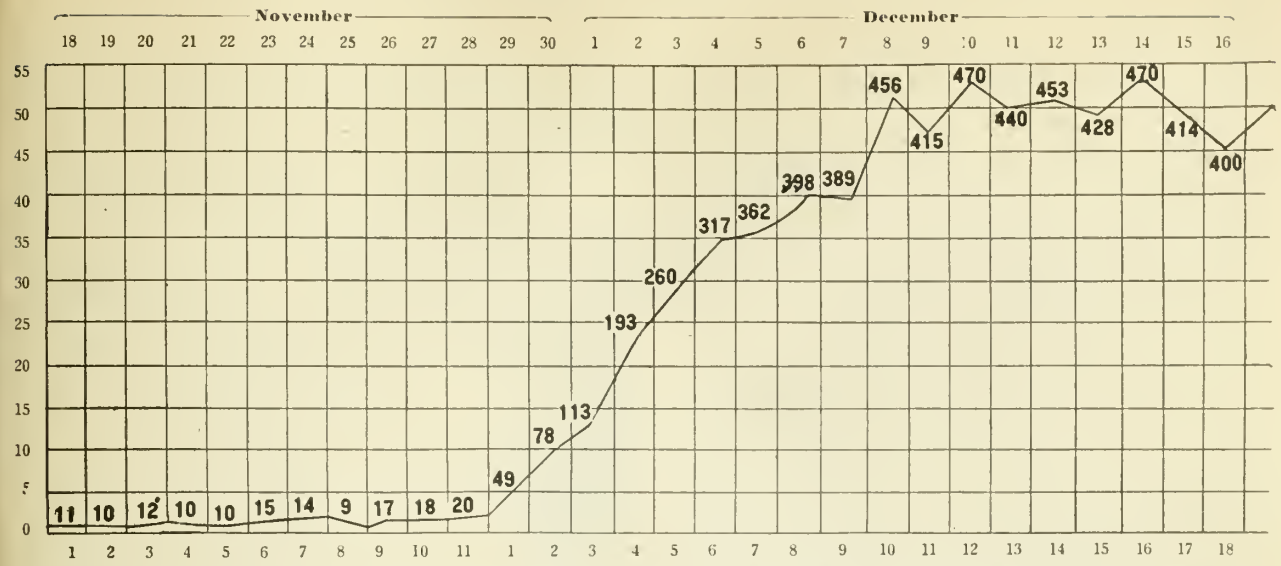


CHART 1—CURVE OF EGG PRODUCTION IN FLOCK OF 875 LEGHORN HENS UNDER ARTIFICIAL ILLUMINATION

The figures on the left represent increase of percentage, while those across the bottom represent days of the month. Starting with a total production of 11 eggs on November 18th, the production line shows in graphic manner the percentage of daily production up to and including December 16th. These Sunny Crest Leghorn hens were placed under artificial lighting on November 18th. As will be seen, illumination showed practically no effect until December 1st, when the egg yield more than doubled over the preceding day, and in 10 days increased from 2½ to over 50 per cent, or from 20 to 456 eggs. The actual number of eggs produced daily is given in each square.

with, which gives the egg yield of the 350 pullets not illuminated and egg yield of the 70 pullets that were illuminated: "On January 29th—nineteen days from the time the lights were turned on, the 70 pullets laid five more eggs than the 350.")

In the foregoing test, as set forth in tabulated form, the Cornell laying ration was fed in equal amounts per fowl to both lots throughout the period covered by this report.

Chart 2—Production of Flock of 420 S. C. White Leghorn Pullets Hatched in April and May (1917), Hillhurst Farm, Orchard Park, N. Y.

Prior to January 10th, 70 Pullets (One-Sixth of the Flock) Were Separated From the Rest and Their Pen Illuminated. This Record of Production Covers Period From January 10th to February 9th (1918) Inclusive.

CHART 2

	Not Illuminated		Illuminated	
	Eggs laid by 350 pullets	Per cent of production	Eggs laid by 70 pullets	Per cent of production
January 10	71	20.3	18	25.7
January 11	75	21.4	20	28.6
January 12	86	24.6	12	17.1
January 13	74	21.1	16	22.9
January 14	74	21.1	18	25.7
January 15	74	21.1	22	31.4
January 16	73	21.	21	30.
January 17	60	17.1	24	34.4
January 18	64	18.3	27	38.6
January 19	62	17.7	29	41.4
January 20	51	14.6	23	32.9
January 21	56	16.	30	42.9
January 22	68	19.4	32	45.7
January 23	45	12.9	39	57.1
January 24	72	20.6	42	60.
January 25	52	14.9	48	68.6
January 26	59	16.9	42	60.
January 27	55	15.7	46	65.7
January 28	64	18.3	47	67.1
January 29	50	14.3	55	78.6
January 30	57	16.3	48	68.6
January 31	46	13.1	37	52.9
February 1	52	14.9	55	78.6
February 2	55	15.7	42	60.
February 3	60	17.1	50	71.4
February 4	53	15.1	50	71.4
February 5	54	15.4	39	55.6
February 6	63	18.	43	61.4
February 7	57	16.3	52	74.3
February 8	63	18.	44	62.9
February 9	72	20.6	40	57.1
Total eggs	1917		1108	
Average per cent of production	17.65		51.1	
Value of eggs	$83.04		$47.01	
Eggs from Jan. 24-Feb. 9	1084		790	
Average per cent of production	18.22		63.53	
Value of eggs	$46.95		$34.11	
Cost of feed Jan. 24-Feb. 9	$56.00		$11.04	
Net loss above cost of feed	$ 9.05			
Net gain above cost of feed			$23.07	

Earned Three Times as Much

The total of eggs laid by the 350 pullets, January 10-February 9 inclusive, was 1917, which at the current prices were worth $83.04; the total number of eggs laid in this period by the 70 pullets was 1108, the market value of which was $47.01. The 350 pullets (five times 70 pullets) laid only 809 more eggs than the 70 pullets under lights. During this period each pullet in the 350 earned 23 2-3 cents (average) in market value of eggs produced, whereas each of the 70 pullets under lights earned 69 cents, as figured on this basis.

In this experiment, we find that the pullets under lights did not respond FULLY, as compared with their mates that were not under lights, until the end of about two weeks. In other words, the 70 pullets were placed under lights January 10th, on which date they produced 25.7 per cent of eggs and after that the percentage mounts up slowly for ten or twelve days, but reached a 60 per cent yield the twenty-fourth day, just two weeks after the lights were put on them. However, a large increase was obtained by the ninth day. Compare these percentages, day by day, with those credited to the 350 pullets that were not under lights.

Next Mr. Moseley made a comparison of the egg yield of the two lots of fowls from November 24th to December 16th inclusive, at which time the 70 pullets were responding liberally to the lights—so it appeared, and he also compared the feed cost on the basis of egg yield.

From January 24-February 9 inclusive, the 350 pullets laid 1,084 eggs, while during this same time the 70 pullets (one-fifth as many) laid 790 eggs, a difference of only 294 eggs in favor of the 350 pullets. The market value of the 1,084 eggs during this period was $46.95, whereas the market value of 790 eggs laid by the 70 pul-

lets was $34.11, a difference of $12.84 in favor of the 350 pullets, to help out on the much larger feed bill, labor cost, etc.

Mr. Moseley's original chart shows that from January 24th to February 9th inclusive, it cost $56.00 to feed the 350 pullets. Thus, after we take the market value of their eggs from this $56.00, we have a loss of $9.05. On the other hand, Mr. Moseley gives the feed cost of the 70 pullets as $11.04, which amount, deducted from the market egg value of their product from January 24th to February 9th inclusive, leaves a profit over feed cost of $23.07.

Just Good Average Leghorns

No claim is made for any of these 420 pullets as regards special high egg production—neither that they had been bred for prolific egg yield, nor that they had been culled by any modern test with a view to throwing out the low producers. It is our understanding that they were simply a good, fair quality of S. C. White Leghorns, bred at that time on utility lines, generally speaking, but that they were of a favorable age, of good size and in a healthy condition. How much better could now be done with line-bred stock or with birds expertly culled; also what improvements might result in egg yield from the use of cooked foods and drinking water with the chill taken off, are questions left undecided by these tests, but which now invite earnest thought and painstaking efforts on the part of men like Mr. Moseley and many others in this field of effort who are qualified for investigational and experimental work of this kind.

With a view to making more impressive, in behalf of our readers, the results of this test of 70 pullets under lights as compared with 350 that were not placed under lights, R. P. J. has had Chart No. 3 prepared, as shown herewith. The figures along the left-hand side, reading from the bottom up, show percentages of egg yield. The dates of the month, January 10 to February 9 inclusive, are shown by the figures along the bottom. The two irregular lines illustrate the egg yield of the 420 pullets; the one marked "illuminated" showing the yield of the 70 pullets placed under lights, and the line marked "not illuminated," showing the production during this period on a percentage basis of the 350 pullets that were not under lights.

Sunny Crest Farm for a number of years has had its own plant for generating electricity. An illustration of same is shown herewith, including the switchboard and set of clocks for turning the lights on and off either all at one time or gradually, depending on when this is to be done. In the forenoon when there is sufficient daylight for the use of the hens, all the lights can be turned off at once, by automatic means as determined by the time clocks, but in the evening it is necessary to diminish the light gradually in the poultry pens, otherwise the hens will be unable to find their way to the roosts. Nature's method in this respect needs to be imitated.

At Sunny Crest, the pens, in most cases, are 16x18 feet in size, though some of them are 18x26 and as a rule they use one to two 60-watt lights to each pen. Said Mr. Moseley in substance:

"For pens 16x18 feet, or 18x26 feet, as examples, we advise using two 60-watt lights, locating them a proportionate distance apart across the center of the room and using a white enameled reflector above each light, of ten to twelve inches in diameter, although a smaller diameter also gives good results. A tinsmith or other handy person can easily make a reflector out of galvanized iron, using two coats of white enamel to make it complete. Remember that a white interior also increases the brightness of the room or laying pen. When electric power is plentiful it is well to have an abundance of light. The cost of what might be deemed a surplus of light is negligible in comparison to the benefit of full light, owing to the fact that the hens will work better in all parts of the room."

Should Take Chill Out of Water

For prolific egg yield Mr. Moseley believes that the chill should be taken out of the water, especially in extreme cold weather; therefore they recently put in one or more large water tanks, with a natural gas burner under each tank. This burner gives a small flame and burns constantly day and night. The water is under low pressure, is carried by pipes to the poultry pens and there drips steadily into the drinking troughs, thus insuring not only water with the chill off, but a continuous supply of pure, fresh water.

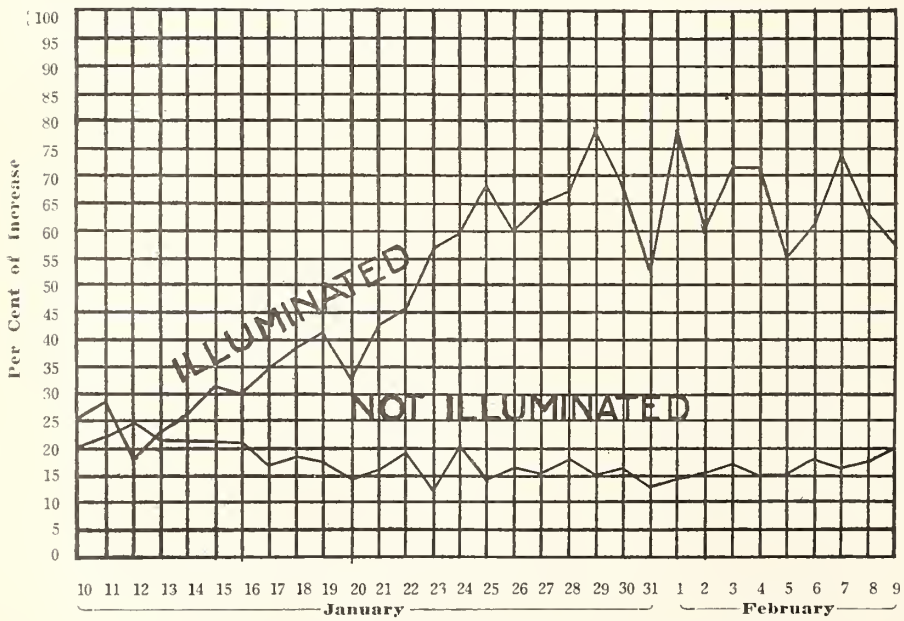
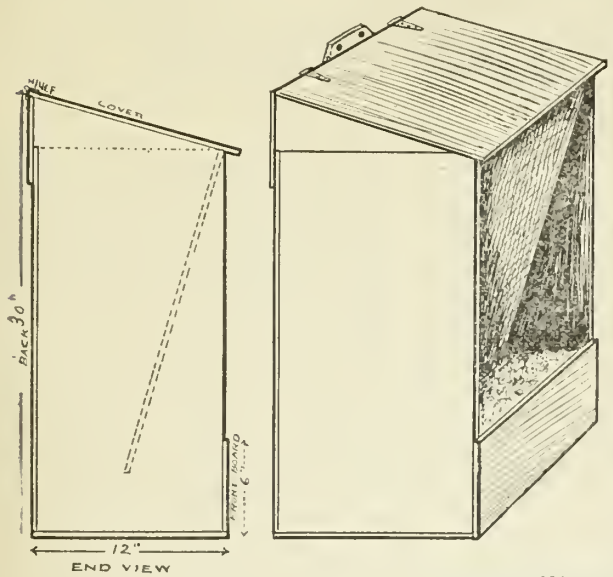


CHART 3—CURVES OF EGG PRODUCTION IN ILLUMINATED AND UNILLUMINATED FLOCKS

The upper line marked "illuminated" represents the production line of a flock of 70 pullets under artificial illumination at Hillhurst Farm, while the lower line marked "not illuminated," shows the production of a flock of 350 pullets kept under similar conditions, but not illuminated. The figures on the left represent per cent of increase, and those along the bottom, the days of the month. The actual number of eggs produced by each flock daily will be found in Chart 2.

As stated elsewhere in this issue (see interview with Dr. E. C. Waldorf beginning on page 64), Mr. Moseley has learned as a result of study and observation in Erie County that moderate temperatures for the poultry quarters during severe cold weather helps materially to increase egg production where the lighting system is employed. This has been observed uniformly (other things being equal) in cases where farm flocks are housed during winter weather in the basements of barns, notably cow barns occupied by numerous head of cattle. Here the temperature averages ten to twenty-five degrees warmer than would be the case in the average poultry house and the egg yield is helped here by the use of artificial illumination (whether furnished by lanterns, natural gas or electricity) and the results are considerably more favorable than can be obtained in ordinary poultry houses from the same fowls, at the same time, given the same feed and treatment, except being subjected to a temperature ten to twenty-five degrees colder.

As above intimated, all sorts of lighting schemes are now being used or "tried out" in Erie County, so Mr. Moseley reported. Ordinary kerosene lanterns are being used, also special gasoline lanterns; likewise natural gas, employing Welsbach burners to give maximum illumination. Furthermore, in a number of cases the poultrymen (both experts and farmers) are furnishing their layer-



A SIMPLE HOPPER FOR DRY-MASH FEEDING

The hopper here illustated is simple, practical, and can be made by any one at slight expense. Dimensions may be modified to suit size of flock. For feeding large numbers of hens, however, extra-big hoppers like the one illustrated at foot of page are more satisfactory.

flocks with artificial heat, generally in the form of stoves that use natural gas, although in a few cases kerosene stoves are used—and with generally good results. Natural gas has not been found as satisfactory as electricity for lighting purposes, but it does help to moderate the temperature of poultry houses or other laying quarters in which it is used to supply light. Said Mr. Moseley in substance:

"The benefits of artificial illumination can be said to be established, so far as Erie County is concerned, both in cold and open weather, also when used by specialized poultrymen and by farmers. In this county it may properly be said that the use of artificial illumination, other conditions being approximately right, has been a uniform success. Here where natural gas is available at low cost, we advise the use of this source of light and heat, including the Welsbach burner which gives a maximum light in the case of gas, provided electric lights are not available."

Touching on another question of importance, Mr. Moseley said:

"The lighting system also can be made a big help to breeders. They can allow cold weather and short days to hold back their fowls until the time in February or early March, depending on latitude, when they want eggs for hatching purposes, then they can put on the lights for ten or twelve days and the egg yield will double or triple, thus giving them an ample supply for early hatches. So far as I know or can judge, the use of lights does not affect fertility. Eggs produced under the lighting system, or forced in this way, will hatch as well as they would if produced by the same fowl in fewer numbers. To the best of my knowledge, the eggs in our breeding pens are as strongly fertile under lights as otherwise."

In a later issue we plan to report the feeding methods used at Sunny Crest Farm. (See article beginning on page 60.)

(NOTE: The foregoing article is reprinted from the April, 1919, issue of R. P. J.)

ARTIFICIAL LIGHTING OF PACIFIC COAST POULTRY HOUSES

(Continued from page 52)

12 quarts of short-sprouted oats, fed in good, clean litter. By daylight the droppings boards should be cleaned and the lights turned off. Clean the water pails thoroughly and give them a good scrubbing, then refill with clean water, and milk if you have it.

"At 3:45 p. m. give them about nine quarts of mixed grain in the litter, composed of a commercial scratch grain, or two parts of wheat to one part of cracked corn. At about 4:00 o'clock, or whenever it begins to get dark, turn on the lights. At 5:00 p. m. give them fresh water, then if the birds have eaten all the grain they will, feed them a wet, lumpy mash made from the egg mash mixed with milk. Feed it to them in troughs at about 7:00 p. m. At 7:30 give the birds all the kale they will eat. The birds will literally stuff themselves and go to roost at 8:00 or 8:30 with plenty to last and keep them warm until the light is turned on at 5:45 the next morning. By 8:30 p. m. we have all the lights out but one, which gives just enough light for Biddy to find her roost.

"Shell, grit, charcoal and egg mash, dry, are constantly before the birds.

"The egg mash is composed as follows, by measure: Two parts bran, one part corn meal or feed meal, one part soy bean meal, one part oat middlings, one part wheat middlings, half part fish meal or beef scraps and one part alfalfa meal. The latter may be omitted if you have plenty of green food for the birds. Twice a week a little cut green bone is added to the wet mash, this being a good substitute for bugs and worms.

"The two big 'secrets' in getting winter eggs are to have pullets bred and raised with winter eggs in view, and the production of spring conditions as nearly as possible."

(NOTE: The foregoing article is reprinted from the February, 1919, issue of R. P. J.)

"EFFICIENT" STRAIN OF S. C. WHITE LEGHORNS "UNDER LIGHTS", SUNNY CREST POULTRY FARM, EAST AURORA, N. Y.

Above picture, made from photograph, shows part (one side) of giant feed hopper located in partition, holding at one time 1200 lbs. of dry mash, as used on Sunny Crest Farm., Has same construction on other side, for use of the birds in adjoining pen. Provides twelve lineal feet of feeding space for each pen, "giving all birds a chance", as Mr. Moseley expressed it.

"Works the Hens Day and Night"—Report By Mr. Jordan

PROPRIETOR OF SUNNY CREST FARM, EAST AURORA, ERIE COUNTY, NEW YORK, GIVES EARLY HISTORY OF HIS EXPERIMENTS WITH THE "LIGHTING SYSTEM" AND TELLS OF THE PROFITABLE AND SATISFACTORY RESULTS OBTAINED — CAUTIONS AGAINST A MISUSE OF LIGHTS BY OVERDOING IT, ESPECIALLY IN THE CASE OF FOWLS KEPT FOR BREEDING PURPOSES — EMPHASIZES THE GREAT IMPORTANCE OF PROPER FEEDING WHERE HIGH EGG PRODUCTION IS SOUGHT — HAS FOUND SPROUTED OATS TO BE AN UNEXCELLED FORM OF GREEN FOOD FOR WINTER USE

By J. P. JORDAN, New York City, N. Y.

(NOTE: The following article is reprinted entire from the Cornell Countryman, the official paper of the New York State College of Agriculture, Ithaca, N. Y. Article is printed herewith with the consent of the publishers of the Cornell Countryman. Mr. Jordan, author of the accompanying article, is a member of the firm of C. E. Knoeppel & Co., Inc., No. 6 East Thirty-Ninth St., New York City, well-known efficiency engineers. It was natural, therefore, and in line with his business training that Mr. Jordan at Sunny Crest (for several years his summer home) should have given special attention to "efficiency methods" in developing his poultry plant. This farm comprises fifty acres of land, consisting of well-drained, gravelly loam that is good growing soil for vegetation of all kinds native to that section.—Editor R. P. J.)

THE Sunny Crest Farm began operations in 1912. It was our plan to grow the best utility S. C. White Leghorns we could, under the most efficient methods possible. Producing poultry as a fad was not our intention. We believed that the reason of so many failures in the poultry business was due to lack of proper attention to details in care, breeding and management. The first year brought its problems, as did later years, but this was particularly true the first year and we were fortunate in looking to the Cornell Department of Poultry Husbandry, at Ithaca, N. Y. for guidance. If we have ever been in a position approaching real success in breeding S. C. White Leghorns, we owe the greater part of the credit to the advice and interest of our good friends at Ithaca.

In 1913 we started to cull out the unprofitable hens and purchased eggs from the descendants of the well-known "Lady Cornell". Next we bred the cockerels from those eggs to five hundred selected heavy layers. During this time we culled our chicks very strictly and in each successive year, having tested the great value of keeping only the very strongest and most perfect birds, our culling has become absolutely merciless.

We also at this time picked from our flock, which had grown to 3000 layers, the finest specimens, and from these made up special hatching pens from which we kept the finest cockerels for the next year's breeding.

The final results of the merciless culling, and of breeding only from the very finest birds, have more than justified what seemed at the time to be a prodigal waste of bird life.

MR. J. P. JORDAN, NEW YORK CITY, N. Y.

President of Sunny Crest Poultry Farm, Inc., East Aurora, N. Y.

Mr. Jordan was one of the first men in the eastern part of our country to discover and recognize the commercial value of artificial light to increase egg production during the short-day period of each year or season.

Ideal Conditions "At Every Season"

One of the principal lines on which we have worked has been that of trying to stimulate ideal conditions at every season of the year. This is most strikingly brought out in two points, one of great magnitude, and the other quite interesting and certainly valuable.

The lesser point is a scheme used in the production of green food in the shape of sprouted oats. Our oat sprouting cellar was so designed as to have an equal temperature throughout, using ventilating stacks to draw the cold air from the floor, which has the effect of drawing down the heat, thereby equalizing the temperature throughout the room to a marked degree.

The principal point in the production of sprouted oats is the method used in wetting them. We have a common thirty-gallon hot water boiler, with the hot and cold water piped to a common pipe in which we mix the water to a constant summer rain temperature. In this condition the water goes into the boiler, being carried to the bottom through a pipe from the top. To fill this boiler we open a valve which allows the air to escape.

When the boiler is filled with water at the right temperature, we close the relief valve, and, having compressed air at our disposal, we open the compressed air valve just sufficiently to give us a proper pressure to distribute the water through the hose and into a three-foot pipe. By this method we can reach into our trays, which are two feet deep, giving each tray a wetting of water at a constant temperature. By this method we produce the very finest sprouted oats, getting twenty to twenty-two pounds of green food from four pounds of oats in seven days. Beside the green food, the oats are in a perfect milky condition, which in themselves are most agreeable to the birds.

THE GREATEST THING at Sunny Crest, however, is the introduction of electric lights. We started experimenting with electric lights in late November, 1915, and to tell of the results seems like a fairy tale. We first installed the lights in our No. 2 house consisting of five pens of pullets, with 100 birds to each pen. These particular pullets were the poorest ones we had out of 2100, the 1600 best ones being in our No. 3 house.

To make our test of far greater value, it happened that nature came along at this particular time with the coldest and bitterest weather of the entire year. Remember this—the 500 pullets in the No. 2 house in which we turned on the lights were the weakest, smallest and most unpromising of our entire flock. We greatly regretted that two pens, or 200 of the birds, we had not sold to market.

The No. 2 house in which we installed the lights was running an average of about 20 per cent production at the

time we started the experiment. The No. 3 house was running between 35 per cent and 40 per cent at the same time.

Three weeks from the time we turned on the lights the production of the entire No. 2 house under the electric light had soared to 65 per cent. Our No. 3 house with our finest birds sank to a production of 20 per cent.

It is needless to say that we immediately installed the lights throughout our entire plant. They have been used ever since with considerable profit. They have not only been used by the Sunny Crest company, but nearly everyone in and about East Aurora has installed the same light outfit.

This is our method of operating the lights. We have a small switchboard which consists of a resistance on the back, and on the front of the board a series of five alarm clock snap switches. Whenever it becomes dark in the afternoon the lights are turned on. At eight o'clock at night an alarm clock goes off and releases a spring switch which throws a light resistance into the current. From five to ten minutes later, the second clock throws in still more resistance. This dims the lights so that it makes it difficult for the birds to see enough to pick up food. From five to ten minutes later, the third clock throws in still more resistance, which brings the light down to a red glow, too dark for the birds to see anything except the roost and how to get to their places for the night. The fourth clock snaps the lights out for the night. At from five to five-thirty the next morning, the fifth clock throws the switch turning on all lights full strength, upon which the birds hustle off the roosts, reminding one of Niagara Falls, seemingly glad to get down and do some good hard work and to get warmed up.

Many joking comments have been made on working the poor birds overtime. But what if you had to go to bed at half-past three or four o'clock on a winter afternoon, your food all digested by ten or eleven o'clock at night, and then you had to huddle yourself up as best you could until half-past seven or eight o'clock the next morning before you could see enough to work for your living? You would soon become discouraged with life, contract all diseases born of weakness, and fail to produce your share of the interests of life which you would otherwise produce if you were given the opportunity.

IN THE OPINION OF THE WRITER, THE RESULTS OBTAINED FROM ELECTRIC LIGHTS IN A POULTRY PLANT ARE EXACTLY AND ONLY WHAT WOULD NATURALLY BE EXPECTED.

More exercise, more feed,—especially dry mash—more water by almost treble, and there follows these results: better health, stronger constitution, greater strength, and lastly, the logical end of it all—namely, far greater egg production.

There is no question whatever in the mind of the writer so far as our experience has shown to date, that the effect of the electric light in the pullet year of the bird can be anything but of the very best. If it is true that the effect of the use of light is to give health and strength, it would naturally follow that it is good for the bird.

It is to be believed, however, from our experience of last year, that the electric lights should not be used with breeders, that is yearlings from which breeding eggs are to be taken. Our reason for saying this is that when we had considered our birds practically through the molt last winter, we turned on the electric lights thinking that we would get them nicely speeded up for the breeding season.

There could be no question in anyone's mind about the speeding up, as we jumped 875 breeders from a total production of 20 eggs per day to a total of 470 in a period of less than three weeks.

When we started up our incubators, however, our egg production started to go down, the hens having started to molt and, worse than anything else, our egg fertility was the lowest we have had for a number of years.

Special pens which were not under the lights, were just the reverse. This seems to point conclusively to the fact that we had overworked the breeders at a time when they were least prepared for standing the work.

The chicks which did hatch, however, were strong and healthy.

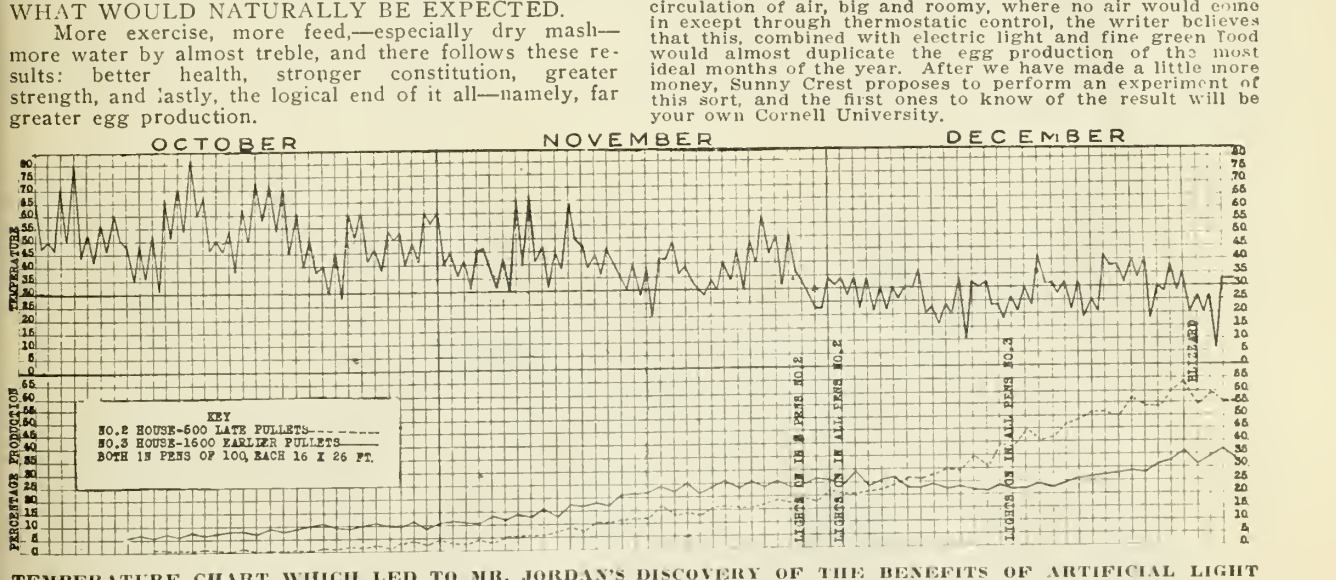
The writer would later like to go on with some points in regard to our business. It is desired to reiterate that those, who are now in or are contemplating going into the poultry business, should do so only under the advice and direction of experts whose life is devoted to the many problems of a very complicated and precarious business.

It, of course, is true to some extent that all poultry plants are a little different, but in the main there is not difference enough to warrant such fool things as feeding all corn because wheat is high or all wheat because corn is high. It is perfectly in order for a progressive operator of a poultry plant to try experiments of great value to himself and to everyone in general, but such experiments should be on small units and careful records kept of the results.

An instance of the above is a theory of the writer that some day we will see poultry plants with automatic temperature control which, with the use of the electric light, and careful growing of green food, will produce conditions almost identical with the months of the year in which the birds produce the greatest number of eggs.

The Sunny Crest Company have kept temperature records for the last three years, and we have studied the temperature effects on birds, as well as general climatic conditions. We found that the temperature seemed to be really the only controlling feature and that the effect of a change of temperature either way was noted on the sixth or seventh day following the change.

If we could now devise a poultry house with artificial circulation of air, big and roomy, where no air would come in except through thermostatic control, the writer believes that this, combined with electric light and fine green food would almost duplicate the egg production of the most ideal months of the year. After we have made a little more money, Sunny Crest proposes to perform an experiment of this sort, and the first ones to know of the result will be your own Cornell University.



TEMPERATURE CHART WHICH LED TO MR. JORDAN'S DISCOVERY OF THE BENEFITS OF ARTIFICIAL LIGHT

The original idea, on the part of Mr. Jordan, in keeping this temperature chart was to find out what effect sudden or severe changes in atmospheric temperature would have on egg production in the case of birds not under lights. From October 10, 1915, when this chart was started, none of the birds here represented were "under lights." The dotted line shows the production of 500 "late pullets" from October 10th to November 28th without lights. On the latter date lights were introduced in three pens of House 2 (containing the 500 late pullets) and December 1st, three days later, "lights" were given all these 500 pullets. On the other hand, no lights were given the earlier-hatched pullets in House No. 3 (1600 in number) from November 10th to January 1st following. Now compare the production. The late-hatched pullets, as might have been expected, were lagging behind the earlier-hatched pullets in production, but within ten days after they were "given the lights" they passed the earlier-hatched pullets and soon were producing forty to sixty-five per cent of eggs, in the cold month of December, while their competitors not under lights (the "earlier" pullets) were ranging from twenty-five to thirty-six per cent—a big gain in favor of the "lighted" late-hatched pullets. It is shown by this temperature chart that while changes in temperature DID affect egg production, it was not to any radical extent, as may be noted by the key to this graph. All pens that held the 500 late pullets and the 1600 earlier-hatched pullets were 16x26 feet in size.

More "Lighting" Facts From Sunny Crest Farm

LATEST INTERVIEW WITH R. S. MOSELEY, SECRETARY-MANAGER OF SUNNY CREST FARM, EAST AURORA, NEW YORK, ON USE OF ARTIFICIAL LIGHT TO INCREASE EGG PRODUCTION DURING SHORT-DAY PERIOD OF THE YEAR— SHOULD FEED LOTS OF GREEN FOOD, SPROUTED OATS PREFERRED — "LIGHTS" OF SPECIAL HELP TO LATE PULLETS—MODERATE TEMPERATURE OF GENUINE IMPORTANCE — FRESH, PURE AIR ESSENTIAL — "LIGHTS" ALSO HELP HATCHABILITY

Report By EDITOR

THE first week of August, 1919, writer paid a visit to Sunny Crest Farm, located about a mile and a half from the thriving village of East Aurora, N. Y., and had a further interview with Mr. Moseley, secretary of Sunny Crest Farm, Inc., and general manager of this fifty-acre poultry plant where the "efficient strain of S. C. White Leghorns was originated and where today they now exist by the thousands. Writing R. P. J. under date October 16, 1919, Mr. Moseley said: "We contemplate making greater strides than ever before, within the next year, including the buying of additional land and in other ways, which will make our plant still more efficient, as to labor saving features and as a money-maker."

Mr. Moseley took us over the plant, through the numerous buildings, describing their facilities and explaining their methods. Treating on the matter of "the use of artificial light to increase egg production during the short-day period of each season" he said, in substance:

"Yes, we are now trying morning lighting, starting the lights at 3:30 a. m. and using no artificial light at night. You will recall how well the birds under lights did at the poultry plant at Cornell University from November last until June of this year—birds that had the lights from 3:00 a. m. until dawn, with no help of this kind in the evening. If that proves to be the best plan we want to test it out here at Sunny Crest and adopt it.

"As regards feeding, we are now giving our lighted birds hard grain at 7:00 a. m. and again at 6:00 p. m. This is during midsummer, so to speak. As the afternoons grow shorter we shall feed earlier; also at that time we shall give them more artificial light, probably turning on at dusk and running up to 6 p. m. This schedule appeals to us, because it provides for feeding of grain at the natural time—at about 7:00 a. m. At present from 3:30 a. m. to 7:00 a. m. these birds can help themselves to the dry mash, all they want of it.

"We like the idea of sprinkling a little grain in the litter—quite deep litter and always kept dry—in the midforenoon and midafternoon, doing this to promote exercise.

Should Feed Lots of Green Food

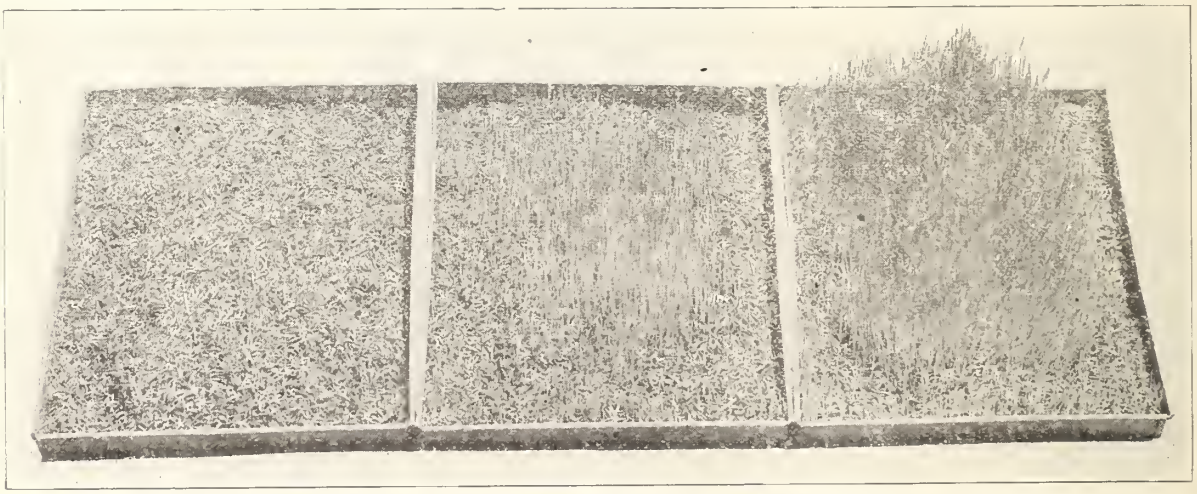
"There is one thing in connection with this use of lights to increase egg production that I feel is very important—that is to feed lots of green food. We believe that poultrymen in general do not, as a rule, feed enough green food, especially in winter. We produce and feed great quantities of sprouted oats and do not believe they have a superior for the purpose. Also we believe in the poultryman being 'a doctor to his fowls' by watching closely their condition of health and production, then when he sees anything 'going wrong' he should act at once and with intelligence.

"Here is another important point: to retard molting in case it starts earlier in the season than you think is natural or necessary, increase the litter to practically a foot deep and every time you go through the pens sprinkle a little hard grain in the litter.

"We have found that more exercise on the part of our layers induces a hardening of the feathers and if the birds are treated in this way they will postpone molting, at least in many cases, and go on laying.

"In regard to the matter of molting, especially unnaturally early molting, we have noted that usually a hen out of condition will stop laying and then soon will go into the molt. We also found that where there appeared to be a lack of exercise, these birds would go into the molt, doing so at earlier dates than was natural or necessary. Our observations on this line have led us to conclude that during summertime this good, dry, deep litter is just as necessary as during the winter, if we are to get high egg production, with or without lights.

"Also it is advisable, in fact necessary at this time of the year (during the summer) to feed more protein, thus to build up the tissues—using buttermilk, for example. We use large quantities of semisolid buttermilk that we obtain by the barrel for this purpose.



SPROUTING OATS ON U. S. GOVERNMENT POULTRY FARM, BELTSVILLE, MARYLAND

Reproduction of photograph furnished R. P. J. by Bureau of Animal Husbandry of U. S. Department of Agriculture. Shows oats in metal trays two days, four days and six days along, respectively. A pound of oats when sprouted will weigh three to four pounds. The sprouted oats do not contain any more nutrients than when fed dry, but they are much more readily digested in sprouted form. The increased weight comes largely from added moisture. Fowls will eat hulls and all. Young and growing chicks greatly relish the green sprouts. Larger chicks eat sprout and hull combined. As a winter green food sprouted oats cannot be excelled. Users of artificial lights in poultry houses invariably report the use and value of sprouted oats and their dependence on them as green food for their laying hens.

"As regards different kinds of green food, our advice to poultrymen in general is to use any good thing they can get. Additional to sprouted oats we used mostly cabbage last winter. We find that our birds prefer a variety, at least to some extent. Sprouted oats are always good, though there is some labor attached to their production. Cut clover or alfalfa are really preferred by us, but the supply is uncertain and often is limited. Will repeat that nothing in this line, however, has given us better results than sprouted oats.

Special Help to Late Pullets

"Under lights you do not have to eliminate from your flock so many late-coming pullets, either those later hatched or those of somewhat slower growth. The lights will bring them along so well that but few will need to be culled out as late starters. The lights seem to be a help in every way, but especially with those birds that are backward. In other words, the lights BRING THEM ALONG, if used properly and with judgment and they all start to lay at about the same time. For this reason we let them lay through the winter, then cull out the early quitters. This is becoming more or less the rule in Erie County, on the part of members of the Cornell Poultry Project. Fortunately, this longer day by the use of artificial light, helps most in proportion to the need of the birds—that is, the somewhat later or undersized birds are helped MOST, proportionately or comparatively.

"You asked me what I think of the matter of temperature in our poultry houses or in quarters where we keep layers, with or without lights. I think temperature is going to play an important part in colder sections of the country. Even under lights birds will lay especially well until a severe cold snap gets them, then they will go off

COMPARISON OF EGG PRODUCTION BETWEEN PLANTS USING AND NOT USING LIGHTS IN ERIE COUNTY, NEW YORK

No. in flocks using lights	No. in flocks not using lights	Hatched	Nov. Prod.	Per Cent	Dec. Prod.	Per Cent	Jan. Prod.	Per Cent
		April,			8014	31	6571	24+
850		May, Jun.			7301	34+	9179	43+
675		May, Jun.	1665	44+	2357	60+	1597	41+
125		May 5th	1622	13+	7376	59+	6762	54+
400		May 1st					3086	59+
168		May 1st	18,830	28+	23,330	35+	25,045	36
2200		Apr., May		28		44		41
*%			5250	7+	15,500	20+	10,625	15+
	2500			21%		24%		26%

Gain in production in per cent from lights.
* Total average per cent production.

Above is a table furnished by Mr. Moseley, of Sunny Crest Farm, that shows a comparison of flocks under lights, with other flocks (totaling 2500 birds) not under lights. It will be noted by this table that there were six flocks under lights, ranging from 125 birds to 2200; also that the November production of the birds under lights was 21 per cent greater than from the birds not under lights—three times greater in fact; that the December production was 24 per cent greater—more than double, and that the January productlon was 26 per cent greater, or nearly twice as many eggs as were laid during this month by the nonlighted flocks.

fifteen per cent, or such a matter, in production. This loss of eggs at the high-price time of the year is serious —it probably comes out of net profits, hence we should prevent it if we can.

"The members of the Cornell Project in this county noticed that when they used a little artificial heat this fifteen per cent reduction and loss was avoided. In this connection dry litter also is important—a fact that you should emphasize. The litter absolutely must be kept dry for greatest egg production.

How to Moderate the Temperature

"Sources of the moderate amount of heat needed, just enough to take the chill out of the air and keep the drinking water from freezing can be obtained in different ways, according to successful practice in this county. Hot water pipes can be used, either just under the floor or on top, or along the front wall beneath the windows. Here at Sunny Crest we noticed that Pen No. 1 in No. 2 house gave us a greater egg production during severe cold weather, to the extent of 10 per cent or more. Our men noticed this before we began the use of lights—noticed it when gathering the eggs day after day. Later, we connected this increased production in that pen with the fact that our water heater for the plant (hot water boiler) was in the basement right underneath that pen. It kept the floor warm and a surplus of warmed air would come up the stairs into the vestibule adjoining Pen 1 and thence found its way into that pen. The combined result was that water would not freeze in this pen and the egg yield was ten to fifteen per cent better. Also this condition helped keep the litter dry. In this connection let me direct your attention to something that Mr. Jordan said on this subject four years ago, as published in the Cornell Countryman:

"'An instance of the above is a theory of the writer that some day we will see poultry plants with automatic temperature control, which with the use of the electric light, and careful growing of green food, will produce conditions almost identical with the months of the year in which the birds produce the greatest number of eggs.

"'The Sunny Crest Company have kept temperature records for the last three years and we have studied the temperature effect on birds, as well as general climatic conditions. We found that the temperature seemed to be really the only controlling feature and that the effect of a change of temperature either way was noted on the sixth or seventh day following the change.

"'If we could now devise a poultry house with artificial circulation of air, big and roomy, where no air would come in except through thermostatic control, the writer believes that this, combined with electric light and fine green food, would almost duplicate the egg production of the most ideal months of the year. After we have made a little more money, Sunny Crest proposes to perform an experiment of this sort, and the first ones to know of the result will be your own Cornell University.'

"Replying to your question about other kinds of heat used on the Project in this country, will say:

"Some use natural gas, using a horseshoe burner, as we call it, located in a simple form of heating stove or drum, thus to secure protection from fire. Additional to this use poultry netting around the stove, a little ways removed, to keep the hens away.

"In one case a successful poultryman is using a Candee Incubator Heater of well known pattern. He uses two pipes along the floor that keep the litter dry and the temperature moderated. Ordinary oil stoves used for heating living rooms also would answer the purpose but no doubt should have extra care against fire risk. The same is true, no doubt, of coal or oil stoves commonly used for heating colony brooders. They can be used, but special care must be exercised. Of course the flame must be protected, as is done in using these heating devices for broods of chicks.

"You ask what is about the right temperature. According to our experience there is no fixed degree. The problem is not so difficult as that. To date our advice would be just enough heat to offset the excessive cold—to take the gripping chill out of the air and prevent water from freezing. It is well known that too much heat is injurious to the health of the birds and will have results quite opposite to those we want. This use of too much heat, so to speak, was tried in Canada some years ago, also in this country and was found to be bad for the birds. Just take the chill off so that the combs are not frosted nor the drinking-water allowed to freeze. As a rule, have the heating element or device (if it is an oil stove or something of that kind) up on a stand or platform, so the birds cannot get near it. And the same is true with hot water pipes. They should be protected in some way so the birds cannot get on them or around them. If a new building is being erected and is to have a concrete floor, run troughs through it for the pipes, or even place the pipes right in the concrete.

Fresh, Pure Air is Essential

"Another matter of importance in this connection:

"We must continue to give the birds plenty of fresh air, by means of good ventilation. Our advice is to keep the windows open, when using most methods of heating, JUST AS YOU WOULD WITHOUT HEAT. Let me mention further that this use of a little heat will mean a big saving in litter. In former years we had to throw out and renew litter once a week—a costly method. Now each winter a little heat prevents this, in large part."

At this interview we asked Mr. Moseley if Sunny Crest Farm had used "check pens" in testing egg produc-

tion under lights as compared with production of other birds not under lights. He replied in the negative and said, in substance:

"Frankly, as a commercial plant, run on business lines, we do not like to spend money on tests, or not too much of it. Let the State Experiment Stations do that. Is not that largely or mainly what they are for? Take our case for example. Four or five years ago Mr. Jordan did not want to hold back a check pen, because when he found out that the use of lights was so helpful, in the way of increased production and so beneficial from the financial point of view, very naturally he wanted to put lights throughout all our houses—and he did so. Somewhat later, however, a number of poultry plants in this section made comparative tests and in every case the results were highly favorable to the use of lights. Am pleased to hand you herewith, for reproduction, if you so desire, the first temperature chart that Mr. Jordan kept or used in this connection. It was the result of this study that caused him to discover, here at Sunny Crest, the wonderful benefits of the use of lights, resulting in their adoption for the entire plant." (See page 59.)

At the time of this visit to Sunny Crest they were installing a new electric lighting plant. Previously they had used an independent plant, generating their own electricity, but by this time the village of East Aurora was able to make it more satisfactory for them to buy power from the village plant, as sold to the local public. The system formerly used at Sunny Crest is known as the Gould Storage Battery System, manufactured by a concern doing business in Buffalo, N. Y.

Asked for a description of the Sunny Crest method of turning the electric lights on and off, Mr. Moseley said:

"Referring to past use and experience, I can do no better than to give you the following description, as written by Mr. J. P. Jordan, President of Sunny Crest Farm, Inc., some three or four years ago:

" 'This is our method of operating the lights. We have a small switchboard which consists of a resistance on the back, and on the front of the board a series of five alarm clock snap switches. Whenever it becomes dark in the afternoon the lights are turned on. At eight o'clock at night an alarm goes off and releases a spring switch which throws a light resistance into the current. From five to ten minutes later, the second clock throws in still more resistance. This dims the lights so that it makes it difficult for the birds to see enough to pick up food. From five to ten minutes later, the third clock throws in still more resistance, which brings the light down to a red glow, too dark for the birds to see anything except the roost and how to get to their place for the night. The fourth clock snaps the light out for the night. At from five to five-thirty the next morning, the fifth clock throws the switch, turning on all lights full strength, upon which the birds hustle off the roosts, reminding one of Niagara Falls, seemingly glad to get down and do some good hard work to get warmed up.'

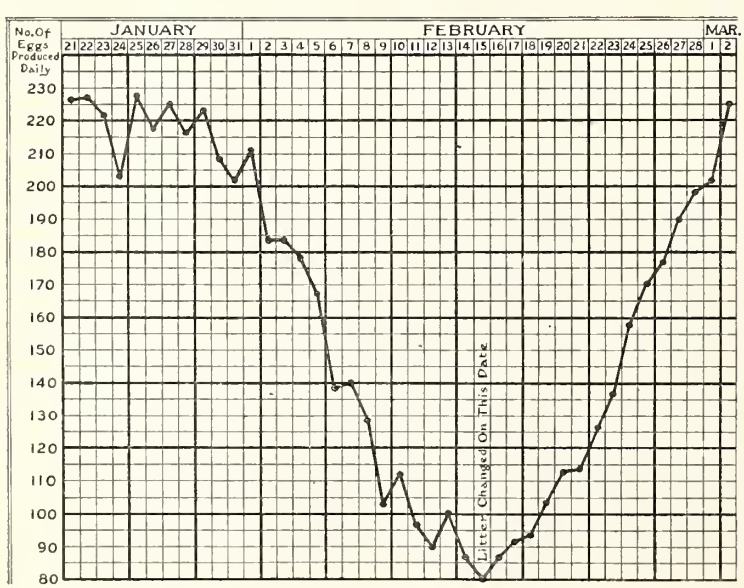
"Our further advice in this connection, is to give plenty of light. We have obtained best results by use of a 60-watt light in the center of each pen, 16x18 feet in size. Two 60-watt lights also will give excellent results in pens 20x20, especially so if the inside walls are painted white. Also be sure to whiten the ceiling. Use white paint or whitewash. We use Carbola, a disinfecting white paint, manufactured by one of your R. P. J. advertisers, the Carbola Chemical Company, Inc., Dept. M, 7 East 42nd St., New York City, N. Y."

At the time of this visit, August 7th, there were but few signs of molting. Mr. Moseley stated that they had done no culling during the preceding six weeks and then had taken out only a crateful from a house that contained about 1500 fourteen to sixteen months' old birds. The combs were all bright red, the egg yield was averaging high and the birds showed no appearance of physical debility from heavy laying "under lights," starting in the early fall of 1918 and continuing to August 7, 1919. These layers, also the numerous pens of breeding hens, were an even lot, ranging in weight from 4 lbs. to 5 lbs. each and showing every sign of contentment.

In recording temperature in poultry houses, extending over a period of several years, Messrs. Jordan and Moseley have used the Bristol Recording Thermometer, made by the Bristol Thermometer Company, Waterbury, Conn. This is a clock affair, so to speak, that records temperature and charts it by the use of red lines—does it automatically day and night, when in operation.

Mr. Moseley was asked if they believed, at Sunny Crest, in using eggs for hatching purposes that are laid by pullets or hens that have been under lights during the preceding fall and winter. Replying, he said, in substance:

"To a considerable extent, that is uncharted territory, but we do believe this: Start your hens under lights in January for the production of hatching eggs in February, depending on how early you want eggs for this purpose. The birds thus to be bred from should be placed under lights about four weeks before you wish to incubate their eggs. But at present we do not believe it is safe or good practice to keep breeders under lights all fall and winter.



AN ILLUSTRATION OF THE IMPORTANCE OF USING CLEAN LITTER

The above chart shows in graphic manner the egg production of a flock of 440 Leghorn hens on a New York egg farm, from January 21st to March 2nd. The litter was badly soiled and should have been removed by January 25th. Instead, it was not changed until February 15th. The black line, which indicates the egg yield, shows the result. It pays to change the litter often enough to keep it reasonably clean. Note in interview herewith what Mr. Moseley says about the importance of clean litter. Needless to say this graph does not show conditions that have existed on Sunny Crest Farm, as managed by Mr. Moseley.

"Our poultrymen around here do this quite extensively—that is, put the lights on their birds four or five weeks before they want to incubate the eggs, and with uniformly good results. One man near here was getting only about four eggs a day, from a flock of nearly 200 should-be layers. In a week's time he was getting over forty eggs a day and the total yield kept on going up **until it passed the one** hundred mark. That was early in February and these birds had been kept over for breeding purposes. About March 1st he took the lights off. and they kept at it—kept laying right along above the hundred mark. By the use of lights he appeared to get them well started—and after that they did not let up all spring. This might be regarded as a single case, but the facts are as I have stated—referring to the taking off of the lights—and therefore this man's experience is worth reporting."

"Lights" Also Help Hatchability

At this point in the interview, editor of R. P. J. read three or four paragraphs from the report of the address of Jas. E. Rice, Professor of Poultry Husbandry, New York State College of Agriculture, on the subject: "Influence of Illumination On The Characters Indicating

The Laying Capacity of Fowls," as same is published later on in this book. Following are the paragraphs:

"Colored charts exhibited by Prof. Rice showed a correlation of these several points, including actual egg production, with earlier changes of external characters, earlier molting of the individual birds, etc. He also spoke at some length about the 'Fertility and Hatchability of Eggs Produced Under Lights', in connection with these 1919 tests and exhibited tables that showed some surprising records. Referring to this particular phase of the subject, he said in substance:

" 'Perhaps I ought not give out this information at present, for fear it may prove misleading. It takes more than one swallow to make a summer and we do not as yet have the data to justify us in drawing conclusions in regard to this very important matter, let alone proclaiming any positive or definite correlation. On the other hand, this information is of such vital interest that I felt you should have it, with these WORDS OF CAUTION as to the very limited amount of data on which it is based. If this one test proves to be the rule, rather than an exception, of that we may be sure. Perhaps it is true and dependable, but we cannot be sure of that until we have ample confirmation.'

"The foregoing timely and earnest remarks by Prof. Rice were meant to apply particularly to a special table of figures he exhibited, showing the influence of artificial illumination on the fertility and hatchability (especially the latter) of eggs laid by certain S. C. White Leghorns kept under lights in tests started November 4, 1918, and continued to June 15, 1919, and thereafter.

"Briefly stated, eggs were incubated from ten testpens 'under lights' and these results developed: the eggs from the check pen of hens not under lights produced 51% in live, strong chicks, while the pen that had lights from 3:00 a. m. each day during the period until dawn, gave 56% in good lively chicks. In the case of pullets, the check pen not under lights produced 56% in good chicks, while the pen of pullets that were given the lights from 3:00 a. m. until dawn each day during the period produced 75% in satisfactory chicks. The other pens 'under lights' for different hours (morning or evening, one or both) and in different amounts, did quite well in hatchability, but not equal to the pen of hens and the pen of pullets that had the lights from 3:00 a. m. until dawn. It appears that in this particular case (see results given further along in this report) the birds, both hens and pullets, that were under the lights from 3:00 a. m. until dawn, not only laid the most eggs throughout the test period, but also laid eggs that were highest in hatchability—that gave the greatest percentage of good strong chicks."

Referring to the above, Mr. Moseley said, in substance:

"We have found that to be true here at Sunny Crest, also elsewhere in Erie County. Of course if hens or pullets are forced into molt, that is different. It begins to look as though pullets that have been under lights all winter will give good hatchability. We have been slow to reach this conclusion, but have had a number of reports in this country to that effect—that higher percentages were obtained from eggs laid by hens under lights than from hens not under lights. Evidently, therefore, the lights truly agree with them, if not overdone.

"Speaking for ourselves, based on our own experiments and records, I will say this: we do not hesitate to put lights on hens during January and February to speed up production for hatching purposes. When we first did this, the high fertility and good hatchability were a surprise to me, because we had been taught to believe that high production, even without lights, would not give high percentage hatches, but not so under lights, if other factors are what they should be.

"Furthermore, I do not see why we cannot use eggs in the springtime to good advantage from well-matured pullets that begin to lay in the fall and lay well during the winter under lights. We are going to try it—to test it out, this coming season here at Sunny Crest, using 600 choice yearling pullets for the purpose.

"While working on the Erie County Project, I found out that the use of lights can be overdone—that they can be kept on too long, for too many hours out of twenty-four. We have reached the conclusion that fourteen to fifteen hours is about right for us in this latitude and climate—that we get best results on that schedule. Use of the lights, or a workday that starts at 5:30 a. m., and ends at 7:30 p. m. is a good practical plan, as regards the egg yield and it also is convenient for the poultryman, for the attendant. In Erie County, also here at Sunny Crest, we have tried both, the fourteen-hour day and the fifteen-hour day and could see but little difference.

"Now, as before stated, we are going to test the morning plan—from 3:00 a. m. till dawn, starting August 15th, or possibly a little later and when the days grow dark early in the afternoon we may use the lights up to 6:00 p. m. The experiment or tests during the winter of 1918 were not conclusive enough to prove that the morning light is best during cold severe weather, as last winter here with us was a moderate one.

"So far, since October 1st, 1918, the morning light has worked perfectly in our case and at this time we have between 1500 and 1600 yearling hens that have not started to molt, yet are laying about 50 per cent production, after having been under lights all last winter and spring. We are going to give this new schedule (Cornell, November 4, 1918, to June 15, 1919) a fair test and if it gives maximum results, as compared with a more convenient schedule, we shall continue it. I refer to the use of the lights in the morning only—that is, from 3:00 a. m. till dawn. Prof. Rice's theory is that despite extremely cold weather these birds, if lighted as early as 3:00 a. m., will get off the roosts, go to work, exercise vigorously and thus warm up and do better laying as a result. Experiments will show more about this before long, and we then can be governed accordingly."

FEEDING FOWLS UNDER ELECRIC LIGHTS

Notes By R. S. Moseley, General Manager Sunny Crest Poultry Farm, East Aurora, N. Y., Written Under Date, October 16, 1919

"I TRUST that the following feeding schedule and notes may be of interest and benefit to many readers of R. P. J. and of your forthcoming book on the use of artificial light to increase egg production.

"At 7 a. m. give three quarts of grain food to one hundred hens.

"At 9 a. m. scatter a good-sized handful for the one hundred hens in eight inches of dry litter and at this time feed all the green food the hens will clean up in one hour, giving them sprouted oats, cabbage or mangel beets.

"At 3 p. m. scatter another handful of wheat in litter for each one hundred hens.

"Night: Feed all grain that birds can practically clean up. A small quantity, however, left over at he time they go to roost will afford healthful exercise early in the morning.

"If sprouted oats are fed in large quantities in the morning or early forenoon, the grain fed can be cut down to two quarts for the morning ration.

"With us the straw is raked to the front of the laying pen where the windows are, each day or two, so that the litter will be evenly distributed for exercise. Birds face the light when scratching for grain and therefore, as a rule, kick the litter to the rear of the pen.

"I firmly believe that one reason for many poultrymen's flocks shutting down on laying in the summer is that the houses or laying pens receive but little attention in the way of proper litter. Also at this season other things quite commonly are left undone that would detract from cheerfulness and health-giving properties in the surroundings of the birds, not to mention such things as lice and mites.

"The actual condition of our birds, both layers and breeders, is the big controlling factor for high production, outside of heredity. BE YOUR HENS' COMMON-SENSE DOCTOR BY WATCHING THEIR CONDITION! You will find that when they get loose feathered and the production goes down, their livers probably are enlarged. That means not enough exercise, and the best way to make them work (exercise properly) is by the use of GOOD, DEEP, DRY LITTER. The cost of litter of this kind is but a small part, as compared with the benefit through having it in use—plenty of it—and changing it often enough to keep it dry and healthful.

Winter Dry Mash At Sunny Crest

"Our mash consists of the following:

"One hundred pounds bran.

"One hundred twenty-five pounds corn meal.

"One hundred pounds red dog flour.

"Fifty pounds grounds oats heavy and ground fine.

"Fifty pounds ground barley.

"Seventy-five pounds meat scrap if buttermilk is used, otherwise one hundred pounds meat scrap. Semisolid buttermilk (a commercial article) diluted, one and one-half pints to ten to twelve quarts of water, is given both morning and afternoon—about one pailful per hundred hens a day—that is, half a pailful at each feeding.

"Our hoppers for two pens (built in the partitions) each hold 2,100 pounds of dry mash and are long (see illustration on page 57), thereby giving the flocks plenty of lineal space. If it is found at Sunny Crest that the birds lack appetite or appear rather logy, the mash hoppers are shut down for a period of three or four hours in the forenoon.

Late Interview With Dr. Waldorf on Artificial Lighting

TESTED THIS PLAN THREE OR MORE SEASONS, BACK IN THE LATE EIGHTIES AND IS DEEPLY INTERESTED IN RECENT COUNTRY-WIDE PROGRESS OF THE METHOD, ON COMMERCIAL BASIS — SUBMITS TO INTERVIEWS AND TELLS OF OTHER IMPORTANT FACTORS NECESSARY FOR SECURING THE DESIRED RESULTS IN HIGH EGG PRODUCTION — MODERATE TEMPERATURE NEEDED FOR A MOST PROFITABLE YIELD

Report By EDITOR of R. P. J.

THIS spring and summer, in time for publication early next fall, editor of R. P. J. is to compile a book on the use of artificial illumination for increasing egg production during the short-day period of the year. Considerable material already has been collected and arrangements are under way to secure reliable data, giving the results of this method, as practiced on the Pacific Coast, in New York State and elsewhere. Interested readers are hereby invited to write us on the subject, meaning in particular those who have information to supply or suggestions to offer. A main object is to have this R. P. J. book contain a quite full treatment of the subject right down to date, all material to be from reliable sources.

CORRELATION OF PRODUCTION WITH BODY WEIGHT
LIGHT BREEDS
Weight In Pounds

EGG PRODUCTION-PULLET YEAR	8.0	7.5	7.0	6.5	6.0	5.5	5.0	4.5	4.0	3.5	3.0	2.5	2.0	Total
300-271									2					2
270-241								1	10	8	1			20
240-211						2	1	5	16	36	13	2		75
210-181							3	14	32	46	34	2		131
180-151				1		2	10	16	47	44	33	11	1	165
150-121						3	6	9	21	19	32	5	1	96
120-91						1	1	6	9	14	6	7	1	45
90-61									3	5	2	3	1	14
60-31									1	2	1			4
30-1									3			1		4
Total				1		8	21	51	144	174	122	31	4	556
Wt'd Avg.				170		164	164	170	173	178	168	137	123	

VINELAND, N. J., EGG CONTEST RESULTS

Above table shows egg production for two years, November 1, 1916-October 31, 1918, as made by 600 Leghorns (mostly White Leghorns, but a few Blacks and Buffs) at International Laying and Breeding Contest, Vineland, N. J. Down the left-hand side is egg production, ranging from one egg at bottom to 300 eggs at top. Weights of birds are shown across top of table. It will be noted that two of this total number of birds laid between 271 and 300 eggs; that twenty laid between 241 and 270 eggs, etc. Also note particularly that the great majority of these eggs were laid by pullets and hens that weighed between 3 lbs. and 4½ lbs., which also conforms closely to the official Standard weights for Leghorns (as set forth in the American Standard of Perfection) which are as follows: pullet, 3½ lbs.; hen, 4 lbs. Observe that the birds that weighed less than 3 lbs. did not lay very well, nor did those that weighed more than 5 lbs.

In the above mentioned book we shall want to give credit to whom credit is due. One question of interest will be: Who first conceived the idea of lengthening the workday of domestic fowl, especially during the late fall and winter months, by supplying artificial lights? Facts and information on this point are invited from the public in general. So far as writer now knows, E. C. Waldorf, M. D., Buffalo, N. Y., was the first to employ this method, and his "primary reason for attempting forced ovulation was not to obtain more eggs from a given number of hens in a specified time, but to secure eggs of the highest hatchable quality." The foregoing sentence is quoted from an article by Dr. Waldorf, published in the February, 1915, issue of R. P. J., entitled "Ten Eggs Per Week Per Hen and How it Was Done," from which article we quote further, as follows:

"This suggestion developed from the fact that the eggs from hens laying five to seven eggs per week hatched much better than did the eggs from the same hens when laying fewer eggs per week. Close observations along these lines were made for two seasons. It was also observed in connection with these experiments that only the dense eggs hatched in high percentage and that the density of the eggs was not lessened while or during increased egg production. With these facts established, I began my first attempt in forced egg production in December, 1889.

"These experiments were made on the premises of Patrick Kinney, 56 York St., Buffalo, N. Y. A hen house for the purpose was erected, measuring 12x16 feet," etc. * * *

In the article referred to (published in R. P. J. February, 1915) under a sub-heading, "Prolonged Their Day Artificially," Dr. Waldorf reported as follows:

"The proper length of daylight was provided for by the installation of four, 100-candle power, Argand gas burners suspended from the first ceiling (first floor ceiling—house was three stories high) one foot from the outside edge and five feet from the ground. Each burner was provided with a large reflector, throwing the light directly downward. These lights were controlled by an automatic time adjuster and were turned on at 3:30 a. m. and off again at 7:30. They were turned on again at 5:00 p. m. and off at 8:00 p. m. for the night. The results of these tests were published in the Clyde Times, Clyde, N. Y., in February, 1889, the complete daily record having since been mislaid or lost."

The last paragraph of Dr. Waldorf's report or article as published in R. P. J., February, 1915, was as follows:

"The interesting tests here described would have been continued had not the fire underwriters objected to the use of gas (for heating and lighting purposes) in that manner. Electricity and the tungsten bulb offer today a far better light with no risk, and such illuminant is much to be preferred, not only on account of less risk, but also from an absence of dust in the burner itself."

Late Interview With Dr. Waldorf

En route home from Boston and Garden Shows, January, this year, writer spent four days in Buffalo and vicinity, including a visit to Sunny Crest Farm, East Aurora, and had two interviews with Dr. Waldorf. They were short owing to the fact that at that time he was extra busy. He still follows his profession and enjoys a large practice. We wanted to refresh our memory in regard to those early experiments of his, or our understanding of them, also to get new light on the subject, especially with reference to the right temperature for prolific egg yield where the lighting system, so-called, is used during the late fall and winter months in northern latitudes.

The interview published herewith was not submitted to Dr. Waldorf in written form, owing to lack of time, and as the subject matter is more or less technical we ask

readers of R. P. J. not to hold Dr. Waldorf responsible for the exact wording, or shades of meaning. With this explanation, here is what we understand Dr. Waldorf to say:

"As reported in your Journal some four years ago, I started those experiments, back in the late eighties, not to find out how large a number of eggs I could obtain per hen per month or from a given number of hens in any stated length of time during the winter, but my object was to increase fertility and improve the hatchability of the eggs, also to improve the vigor of the chicks to be hatched from these eggs. However, I had heard previously that in sections of southern China it was not unusual for poultry keepers to get seven, eight and even nine eggs per hen per week.

"In thinking over the subject I decided to study the food and chemical elements of eggs and their development in the organism of fowls, with a view to aiding all I could in their production. I not only wanted plenty of eggs as to numbers, but also wished to have them strongly fertile, so they would hatch altogether, so to speak.

"After some study I decided that the necessary nutritive elements must be supplied and in an easy form for conversion in hatchable eggs that would produce strong germs, embryos and chicks. Then I built the special three-story house, as described in detail in your journal several years ago—a house 12x16 feet, heated with hot water pipes and arranged to give quiet and secrecy or seclusion to the fowls. The different pens were separated by tight board partitions and all windows were three feet above the floors, so the fowls could not look out and become discontented or see banks of snow and ice.

Moderate Temperatures For Best Results

"It will be found by those now experimenting in this field that moderate temperature is required, together with a longer workday, in order to get the desired increased production. In this three-story poultry house of mine there were four pens on the ground, as first constructed. One pen, the one in the northwest corner of the house, was about five degrees colder than the others, and I soon noticed the difference in the egg yield during cold periods. Later I corrected this difference by changing the hot water piping. For best results for these test pens, or where high egg production is desired in the short-day period of the year, the temperature should not be below 50 degrees Fahrenheit, while 55 to 60 degrees gives the best results. However, it ought not to be above 60, because in warmer temperatures than this the fowls soon become seriously lousy unless given frequent attention.

"Hot water pipes were used for warming the three-story poultry house and the return flow pipes passed through the food troughs or hoppers to keep the mash warm in cold weather. They also passed through the dust troughs or bins in which sand, dust and coal ashes were kept for the fowls to wallow in. I also cooked all food, including the green food and meat food. I wanted it easily digestible and quickly assimilated. At that time I considered seriously the question of putting a predigested poultry feed on the market, but my practice as a physician made this impractical.

"The nests were specially secluded and this is essential to prolific yield. Fowls are timid. In the matter of nesting and laying, during tests of this kind, also when kept for commercial profit, the layers should not be disturbed. They should be fed regularly BY THE CLOCK, also by the same person, dressed in the same clothes, and gentleness should be the rule. I recall distinctly the case of a neighbor—a woman who was interested in poultry and who wanted to look inside my poultry house and see the fowls. Finally I yielded against my better judgement and although she was in the pens only a few minutes, it took several days to get those fowls back to full laying. Within a few moments after she entered the house the hens began to cackle and they grew more and more nervous and restless till I asked the women to come away.

Eggs Are About 85 Per Cent Water

"Water—fresh, pure water, is of vital importance. Poultry keepers need to remember that 85 per cent of the contents of the egg is water. If fowls under test or kept for commercial profit cannot at all times get good drinking water WHEN NEEDED, this will break up the laying habit and cost one, two or three eggs per fowl per week in the case of birds thus mistreated or neglected.

"Yes, I believe that fowls have intelligence, also that will power is involved, when it comes to the matter of their laying or not laying, at least in many cases. This must be so, because a change of quarters, any real disturbance, also fright, causes the nesting desire to decrease, or the fowl can check it voluntarily and will do so on slight provocation. That is why gentleness should be the rule if high egg production is sought, either per fowl or from a pen or flock.

"If uniform or concurrent hatching is to be obtained in the case of eggs set at the same time or placed in an incubator, these eggs MUST NOT be allowed to undergo incubating temperature till the regular period is started. This temperature exists in the fowl that is to lay the egg; therefore the eggs when formed should move normally from her because if retained they will start to incubate and as a result will be advanced twelve or more hours.

"This is not desirable for best results in hatching. And after the eggs are in the nest they should be gathered regularly, at least twice a day, especially during summer weather so that other laying hens or brooding hens will not advance them another hour, or two or three hours, as the case may be. Then after these eggs are gathered they should be kept in a cool temperature until ready to incubate them regularly. Poultrymen do gather their eggs regularly, as a rule, but not so on many farms.

Protect Hens In Molting Period

"Advise your readers to be sure to keep males away from hens in the molting period. Eggs not laid at this time shrink down to the size of small peas and even smaller. In this condition the male germ attaches to them, joins the female germ and BOTH ARE BLIGHTED. Later when these eggs develop, the female germ is dead and a new male germ is of no benefit in the case of these particular eggs. Such eggs will not hatch or if the blight is not complete, as may sometimes be the case, it means chicks dead in the shell. One to two dozen eggs per hen may be rendered unhatchable in this way, with no benefit whatever to the owner of the hens or to any one who tries in vain to hatch such eggs. In the case of large numbers of hens it means considerable loss, and as a rule

CORRELATION OF PRODUCTION WITH BODY WEIGHT
HEAVY BREEDS
Weight In Pounds

EGG PRODUCTION-PULLET YEAR	8.0	7.5	7.0	6.5	6.0	5.5	5.0	4.5	4.0	3.5	3.0	2.5	2.0	Total
300-271			1	1	2									4
270-241				1	1	2	1							5
240-211			1	2	10	3	2	2		1				21
210-181		2	6	4	18	18	14	5	1	1				69
180-151	1	3	12	16	24	16	8	7	2	1				90
150-121		2	6	5	14	18	12	9	6	1				73
120-91	2	1	4	10	6	15	6	8	4					56
90-61			3	1	5	2	1	4	2	1				19
60-31			1				2	1		1				5
30-1			1				2							3
Total	3	8	35	40	80	74	48	36	15	6				345
Wt'd. Av.	133	155	145	153	166	153	151	141	124	138				

VINELAND EGG LAYING CONTEST RESULTS

Above table shows egg production, pullet year, of Plymouth Rocks, Wyandottes and Rhode Island Reds at Vineland Contest. Weights are shown across top of table. Down the left-hand side is egg production, ranging from one egg at bottom to 300 eggs at top. It will be noted that four birds laid between 271 and 300 eggs each in the 365 days; that five laid between 241 and 270 eggs in the same period, etc. This table also shows that the great bulk of the eggs laid by the 400 birds here represented were laid by pullets and hens that weighed between 4½ and 7½ lbs., which corresponds very well with the official Standard weights of the Plymouth Rocks, Wyandottes and Rhode Island Reds—see latest edition of the American Standard of Perfection for exact weights. These birds were not "under lights."

the incubator is blamed for failure to do the impossible.

"Yes, I endorse in a general way, Mr. D. W. Young's theory or statement relative to the craving that a laying hen has for albuminous food; also that after the brooding fever comes on there is a material change in her appetite, to the effect of her not wanting albuminous food, which helps in shutting off the egg supply while she is incubating a clutch of eggs. That, no doubt, is one of the reasons why the broody hen after she gets a nest full of eggs, can readily discontinue laying for a period of several weeks, although in good health and otherwise in condition to go on laying.

"After the hen has laid she should not be disturbed or excited in any way. In my experiments I noticed that after laying they would go to the third floor—up under the glass roof where it was warm and where they would not be bothered in any way. On large plants the earnest poultryman probably cannot give maximum seclusion to the layers, but he should do all he can in this direction. The feminine instinct and wild nature are still inherent in our domestic fowl to a considerable extent and we must respect these facts if we are to get best results.

"Yes, I believe in the intelligence of fowls; also in what you describe as 'good dispositions.' Intelligence is made evident by their adaptability. Tameness must be cultivated. This can be done with remarkable results. Please say on my authority that tame fowl and the gluttons are the best layers. Horsemen and dog fanciers, time immemorial, have been very attentive to intelligence possessed by horses and dogs, and poultry breeders SHOULD BE. If I were making a living breeding poultry, or if it were my desire to make money in that way, I would not breed from scary fowl, from the excitable kind, from those not responsive to kind treatment. I would pay attention in my selections to those that can be tamed with comparative ease. This would show intelligence or adaptability, which is needed for best results in high egg production, meaning eggs of the right kind and produced at the right time for our purposes."

(NOTE: The foregoing article is reprinted from the April, 1919, issue of R. P. J.)

ADDITIONAL DETAILS FROM DR. WALDORF

In This Communication Dr. Waldorf Gives Special, Valuable Information Regarding the Way in Which He Developed His Method of Using Artificial Light and Heat in His Poultry House

On the subject of maximum egg production by the aid of artificial light I desire to enlarge somewhat upon my paper as it appeared in the R. P. J. of February, 1915 (see page 19, this book), but more particularly to be explicit as to measurements, for the benefit of anyone wishing to conform to my plan. Bear in mind that the form of coop adopted was an evolution, so to speak, begun in 1889, using kerosene oil lamps, in a barn adjoining the building (occupied today by the distributing office of the Magic Egg Tester Works), and culminating in the construction, after four years of experimenting, of my ideal coop directly across the street in the rear of 56 York St. By the way, it may be of interest to know that for the past 26 years continuous experiments with eggs for incubation, with the aid of the Magic Egg Tester, have been conducted on these premises.

Now to return to style and size of coop I believe best adapted to use in forced egg production. My article just referred to states the ground floor as 12x16 ft. This size is the coop proper and exclusive of two aisles three feet wide bisecting in the center. This arrangement gives four apartments each 8x6 ft. Each apartment has an entrance door (matched lumber) at center aisles, 2½ feet wide extending from one foot above ground to within four inches of first ceiling. This gives a door 5 ft. 8 in. long. Four partitions of matched boards, each 7 ft. x 2 ft., are placed upright 2½ ft. from intersection of aisles for support to ends of roosts and ends of droppings boards, the latter being two feet wide, slanting backwards. For the purpose of ventilation a band of wire screen four inches wide encircled the top of each apartment. The floor of the second apartment forms the ceiling of the nests which are one foot square, extending from the upright partition supporting roosts to outside wall of coop. The wire screen affords easy inspection of nests without opening board door.

It will be observed that the floor surface allowed for each section of fowls is 48 square feet multiplied by three —equal to one pen for each group twelve feet square, and far better on account of the privacy allowed and the privilege of additional warmth and comfort not desirable for the ground floor where it would tend to induce colds and facilitate the breeding of lice, difficulties not experienced in the "upstairs" system of cooping. Consequently health, perfect digestion, quick assimilation and maximum egg formation is the result of using the three-floor arrangement.

Perhaps it might be a good idea to dwell more fully on the heating system than was done in my former article. Efficiency and economy were essential factors. A low laundry stove fitted with a water coil and gas burners was used, set in the west end of the excavation, which was 15 feet long and 3 feet wide, covered with flooring for ten feet, with four steps to the bottom of the furnace pit. Fifty feet of one-inch pipe for each section, placed above the windows on ground floor, comprised the radiation necessary for entire coop. A one-half-inch standpipe extending to highest point with expansion tank supplied the necessary pressure for circulation. On the subject of heating I must not omit to say that the outside was banked with corn stalks up to the lower ledge of the windows and this in turn was covered with one width of tar paper to shed the snow or rain. This provision forestalled sudden changes in temperature within the coop.

Attention to coop arrangement, heating and lights, while absolutely essential, must be understood to be simply the FOUNDATION for the business. For example, it interrupts the egg machines to turn on the lights at unexpected moments. Actual experiments proved this. Owing to the exactness of time required I found it necessary to invent a time-trip mechanism called by me "Waldorf Chronometric Adjuster." Application for United States patent for this clock mechanism, already in use, was filed June 1, 1892, and U. S. Letters Patent No. 489350 granted January 3, 1893. The absolute regularity of this device made the daily illumination something that the hens always met with eager satisfaction.

Before my experiments of forced egg production by the use of artificial lighting were concluded in 1893 and 1894 many well-known and prominent Buffalonians became enthusiastic of the method. (The names of these persons will be found in the Historical Chapter, page 4.—Editor.)

While the system at that time proved a success commercially, the greatest benefit, as I felt, was the relief from unhatchable eggs by eliminating their slow formation, which unquestionably is detrimental to normal germ life within the egg before laying and during incubation. This much accomplished, all that remained to be done in order to select the hatchable egg was to learn the required density, as shown my specific gravity test.

This subject suggests a matter uppermost in my mind and should be to every poultry raiser in the world — I refer to the specific gravity of eggs in the unbroken shell, readily determined by the use of the Magic Egg Tester. It is the key to the whole situation of poultry propagation. The great value of specific gravity lies in its ability to show the first atomic chemical change not discernible either to the eye or on the scales. Eggs may show marked change in specific gravity with no perceptible change by the finest scale. Gases must be present to produce this, and these must be detrimental to the egg substance. For proof of this, incubate for 72 hours two classes of eggs, one of high and the other of low specific gravity. Then in a room temperature of 70 degrees carefully remove the shell at the base of each egg. The vessels and arterial pulsation will be strong and vigorous in the eggs of high test but will be weak, frail and disconnected in eggs of lower test, the pulsations ceasing after a few moments in the latter, but surviving for an hour and longer in eggs of high specific gravity test. What evidence of the importance of specific gravity to the poultryman could be more convincing than this comparison?

Successful Use of "Lights" on Commercial Poultry Plant

CAPABLE AND INSTRUCTIVE REPORT ON USE OF LIGHTS ON NEW YORK STATE EGG FARM—GAVE LARGER CASH RETURNS AND DID NOT INJURE HATCHABILITY—LIGHTS USED ON THIS PLANT DURING PERIOD OF FIVE YEARS—COST OF ELECTRIC LIGHT PER HEN PER YEAR, THREE CENTS

By R. T. ARGOOD, Morrisville, N. Y., Poultry Husbandman, New York State School of Agriculture

EXTRACT from letter which accompanied the following article: "I am at present poultry husbandman in the Agricultural School at Morrisville and now and then find time to write up some of my experiences as a poultryman. I personally carried on the work of the enclosed experiment, in connection with my other duties. Numerous inquiries for data on the use of lights in this experiment prompted me to prepare the article herewith." Article kindly sent us by Mr. Argood, was as follows:

The use of electric lights to increase winter egg production has been successful for the last four years on a large commercial egg plant near Oneonta, New York. The proprietor, a wealthy man, started to keep poultry as a hobby. Five years ago he came across an article in a poultry magazine on the use of "lights" to force the production of winter eggs. On thinking the matter over, he decided to try the scheme out, thinking perhaps there might be something in the idea after all.

An experiment was started by trying out "lights" on a pen of scrub hens. A vacant building was fitted up for suitable quarters and electric lights installed. This was during the first of December. In two weeks' time the hens responded with an increased egg yield and kept at the good work through the winter. Inspired by this success, preparations were made to equip all the laying houses with "lights."

Since this trial in 1914, "lights" have been in use each winter in the laying pens. The size of the plant has also been increased from 1000 to 3000-hen capacity and is now managed on a commercial scale.

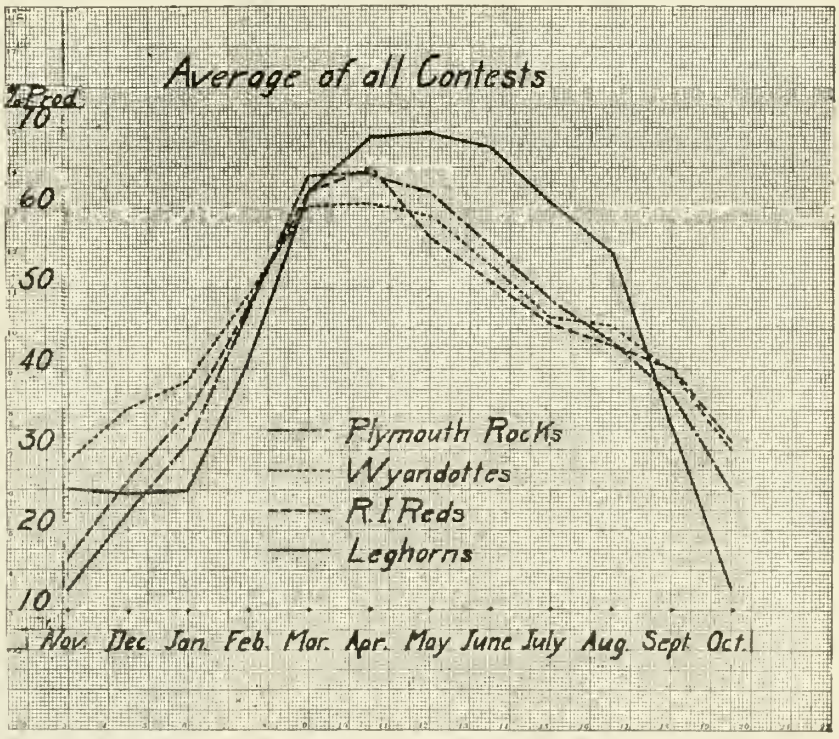
The plan in equipping a laying house with "lights" is to use a 60-watt bulb for a pen twenty feet square, holding 100 hens. The light is placed a little to the front of the pen so that the floor space under the roosting platform receives more illumination than it would when the light is put in the middle of the pen.

The schedule formerly followed was to turn the lights on in the morning at 5:30, discontinuing their use at daylight. The lights were again turned on at dusk and continued until 8:00 p. m. By this plan it was necessary to dim the lights so the hens would find their way to roost. From experience it was later found that a twelve-hour day was sufficient and less electricity used, cutting down the bill for current one-third. During the last year the electric light bill on 2500 layers was $82.00, or a little over THREE CENTS PER BIRD A SEASON.

Under the present plan, the lights are turned on by means of an alarm clock at 4:30 in the morning. In the evening the hens are allowed to go to roost naturally. By this plan the hens have a twelve-hour day and a twelve-hour night. No dimmer is necessary and the scheme fits in better with the regular routine.

The first feed is given at 5 in the morning, which consists of a grain ration well scattered to induce exercise. Much care has to be taken in the feeding methods since the hens under the "light" system have a longer day than is usual at this time of the year and it requires more skill on the part of the feeder to keep the birds "on their feed" throughout the day. To be on the safe side it is well to feed a scant ration of grain in the morning and give all they will clean up at night.

The mash hoppers are left open at all times, unless the hens start wasting or picking over the mixture. Green feed in some form or other is plentifully supplied during the forenoon. It is absolutely essential that plenty of fresh water be available.



AVERAGE PRODUCTION OF HENS OF DIFFERENT BREEDS IN EGG LAYING CONTESTS

To show readers of this book the comparative production of the different breeds, the above graph was prepared, showing the monthly egg-yield (in percentages) of Leghorns, Rhode Island Reds, Wyandottes and Plymouth Rocks, employing for this purpose the actual trap-nest records made at the Vineland, Storrs, Missouri, and North American contest. Not a very great difference, is there? The Leghorns fell behind during the winter months, but laid well from early April until mid-September. In none of these contests were any of the birds "under lights". Unfortunately, "lights" to date have not been commonly used on the Plymouth Rocks, Wyandottes or Rhode Island Reds. No doubt they will respond proportionately well to the helpful effects of a longer workday during which to eat, digest, assimilate and function.—Courtesy of the New Jersey Experiment Station.

When it is dark and dreary a little grain is sometimes scattered about the pen, just enough being fed to "coax" the hens to exercise during the middle of the day. It is the constant endeavor of the poultryman to do all he can to keep the hens busy.

Last winter two pens of Leghorns were selected to try out an experiment on the effect of "lights" on the hatchability of eggs. The hens selected were yearlings, one hundred birds in each pen. They were given similar treatment, except for the use of "lights" in one pen. The experiment was started in December and careful records kept.

"Lights" Also Helped Hatchability

In the spring, eggs were set from both pens at different times during the incubating season. It was expected that the use of "lights" would result in a low hatchability record from the eggs produced in the lighted pen. The results, however, do not seem to bear out that point as can be seen from the data which follow:

How Lights Affect Hatchability

Date Set	Per cent Fertile Eggs 7th Day		Per cent Hatched of Total Eggs Set	
	LIGHTS	NO LIGHTS	LIGHTS	NO LIGHTS
Mar. 6	82.3	80.5	25.5	25.2
Mar. 29	88.0	92.0	60.0	61.0
Apr. 1	86.2	90.8	61.3	61.1
Apr. 13	92.3	91.1	70.0	64.8
Apr. 17	90.5	91.0	47.6	47.0
Apr. 25	92.4	97.5	56.4	61.5
Apr. 29	93.8	97.9	63.2	53.0
Av. per cent	89.3	91.4	53.4	53.3

From the above figures it will be seen that no definite bad effect on the hatchability of eggs could be laid to the use of "lights." The general opinion among poultry authorities to date, however, seems to be rather against the use of forcing methods in producing hatching eggs from breeders.

The egg record from the two experiment pens follows, and it can be seen that the hens in the lighted pen brought in the larger receipts, although the pen without lights laid the larger number of eggs, the difference in profit being due to the season of the year in which the eggs were produced.

Past records from this same farm show that in years when "lights" were used a lower egg record per hen was obtained than in years before the use of "lights" was adopted.

It has also been found that under "lights" there is less trouble than usual with broody hens, since they go through a partial molt in the spring months. Our opinion is that the "lights" will be the means of a revolution in change of methods in egg production.

Experiment on Layers; "Lights" vs. "No Lights"

PEN 1—100 HENS WITHOUT LIGHTS

	Eggs	Price per Doz.	Per cent Production	Receipts
Dec.	14	.69	.4	$ .81
Jan.	154	.71	4.9	9.10
Feb.	430	.57	15.35	20.43
Mar.	838	.43	27.03	29.90
Apr.	1401	.43	46.66	50.16
May	1605	.38	51.77	50.72
June	792	.43	26.4	28.35
	5234			$189.47

Mortality 4 per cent.

PEN 2—100 HENS WITH LIGHTS

	Eggs	Price per Doz.	Per cent Production	Receipts
Dec.	1401	.69	45.19	80.56
Jan.	780	.71	25.16	46.10
Feb.	548	.57	19.57	26.03
Mar.	483	.43	15.58	17.29
Apr.	451	.43	15.03	16.15
May	771	.38	24.87	24.36
June	704	.43	23.33	25.20
	5138			$235.69

Mortality 5 per cent. Cost of electric current for season, $5.40.

From this experiment it can be seen that the hens without "lights" laid 96 more eggs than the hens with "lights," but that the lighted pen made the larger returns. The receipts of the lighted pen with the cost of the electric current taken out, exceeded their competitors by $40.82.

Private Users of "Lights" in Pacific Northwest

TWO OF THEM, D. P. RAGER OF SUMMER, WASH., AND MRS. T. H. RIDLEY OF PUYALLUP, WASH., GIVE SPECIAL AND DIRECT CREDIT TO MR. AND MRS. SHOUP FOR THEIR GOOD SUCCESS — TELL HOW THEY USE "LIGHTS," ALSO WHAT THEY FEED, AND GIVE THE HIGH EGG PRODUCTION PERCENTAGE OBTAINED—EXCELLENT REPORT FROM A. E. HAMMOND OF KIRKLAND, WASH., WHO USED THE SHOUP TYPE OPEN-FRONT POULTRY HOUSE WITH STORM CURTAIN

HEREWITH are three sample letters from the Pacific Northwest, as sent to the Reliable Poultry Journal by private users of artificial light in that section. Other similar letters were received, some of them of more recent date, but the three here given are representative of the uniformly good results that Pacific Coast poultrymen and poultrywomen have obtained by the use of "lights" in a climate that is quite mild, but in a latitude where the winter nights are long.

Letter From D. P. Rager, Summer, Wash.

November 18, 1918.

Editor Reliable Poultry Journal:

Received your letter of Oct. 25th and expected to answer sooner, but have been quite busy. You ask for my experience in using lights on my chickens. Two years ago I decided to go into the poultry business. It was late in the season and I had to take just what baby chicks I could get. Owing to poor stock, inexperience and a backward season, I only raised two hundred and ninety-five laying hens from 1,000 chicks.

Professor and Mrs. Shoup, poultry experts of the Western Washington Experiment Station, strongly advised lights—electric lights if possible, but at any rate lights of some sort. Could not get the electric light company to come out to my place, so had to put in a private plant—30 volt. I placed eight forty-watt lights in my ninety-foot pullet house, dropping them to within two feet of the floor. Began working the pullets from 6 a. m. to 8 p. m. On November 6, I decided to reduce the working hours on account of too high percentage of eggs. In seven days they dropped from two hundred eggs to one hundred and sixty eggs daily and it took me three weeks to bring them back to normal.

This year my pullets again began laying too great a per cent, so am only working them from 6 a. m. to 6:30 p. m. The old hens are working fourteen hours daily and coming through the molt rapidly. I feel sure that the use of lights has shortened the molting time. I have a night light on the lower end of the building as a protection against thieves and can also switch on all the lights from bedroom, in case there is any commotion during the night.

You asked for any pictures I might have showing the lights. Cannot have much luck taking the pictures from the inside, but am inclosing one taken from the outside which shows the position of the lights, also one showing part of the light plant. The wiring is my own work and not a very artistic job, but it answers the purpose.

Prof. and Mrs. Shoup (latter also a decided "live wire") are doing an immense amount of good here in the Valley and I think we all owe them a vote of thanks.

Wishing you success in your campaign for "more light in the poultry house," I am

Yours truly,
(Signed) D. P. RAGER.

Letter of Mrs. T. H. Ridley, Puyallup, Wash.

Puyallup, Wash., Jan. 12, 1919.

Editor Reliable Poultry Journal:

I owe you an apology for failure to answer promptly your letter in regard to artificial lighting for poultry. I must plead as my excuse that I have been so busy caring for my 1050 birds that I have had no time to write letters, even to my mother. I have done alone all the work connected with our 1050 birds, except for the help of my husband before 8 a. m. and after 6 p. m., and of a man for a few hours once or twice a month to remove the litter and do the heavy work that I could not manage. Besides I have done my own housework.

We started raising S. C. White Leghorns February 14, 1916, and have always used lights, so we can give you

no comparative data, but we are convinced that the difference between lights and no lights IS THE DIFFERENCE BETWEEN SUCCESS AND FAILURE.

The first year we used gasoline lanterns on 360 February and March-hatched pullets, lighting them from October 1st to March 1st. That fall we had a good many molt, due to our inexperience in feeding. Our highest production for the year was in December, 1916—67.7%, for the month. The percentages of production were as follows: Nov., 54.2%; Dec., 67.7%; Jan., 1917, 64.2%; Feb., 59.4%.

In April a part of them went through a spring molt, lasting a short time, coming into a 64% production in June and July.

The second year we used a hollow wire lighting system and found it very unsatisfactory, but by a deal of fussing we managed to keep lights going most of the time and our production for the winter months of 1917-1918 was as follows: Oct., 44%; Nov., 68⅓%; Dec., 65%; Jan., 64%; Feb., 59⅔%; a light molt in April and a 58% production in June and July. This was a flock of pullets hatched March 23rd.

This year we have 650 pullets hatched as follows: 320 Feb. 22nd; 193 March 14th; 137 April 18th. In February, 1918, we installed a Lally Light electric system and Oct. 1st we turned on the lights at 6:00 a. m., turning them off at daylight, on again at dusk and off at 7:30 p. m. This plan has been followed faithfully with practically no deviation ever since. We had no fall molt to speak of, only one bird molting enough to lose tail and body feathers while six lost only the neck feathers.

The production for this winter's months was as follows: Oct., 52%; Nov., 64%; Dec., 67%; Jan. (to present writing), 65%.

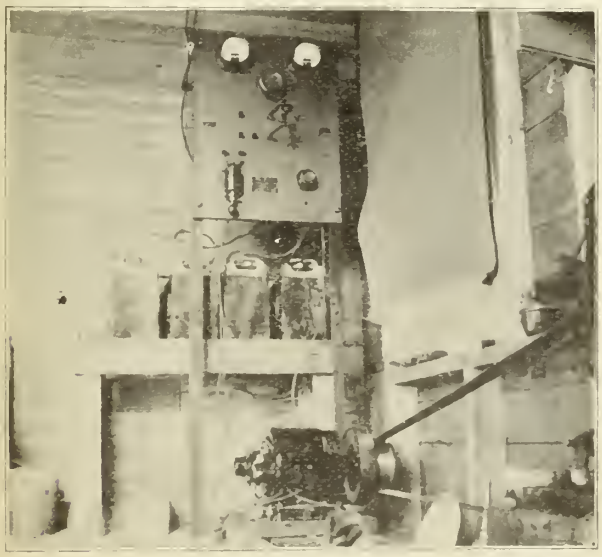
Our birds are looking fine and have been laying since July 4th. They are hatched from our own trap-nested stock. Besides 650 pullets we have 400 breeders. We wished to make an early hatch, so Dec. 10th, as we were getting only about fifteen eggs per day from the breeders and we wanted 2500 in the machines Jan. 21st, we turned on the lights for an hour in the morning and until 6:30 in the evening. The following figures will show you the results:

Dec. 10, 15 eggs	Dec. 21, 29 eggs
Dec. 11, 8 eggs	Dec. 22, 81 eggs
Dec. 12, 15 eggs	Dec. 23, 127 eggs
Dec. 13, 13 eggs	Dec. 24, 139 eggs
Dec. 14, 12 eggs	Dec. 25, 143 eggs
Dec. 15, 15 eggs	Dec. 26, 195 eggs
Dec. 16, 17 eggs	Dec. 27, 215 eggs
Dec. 17, 17 eggs	Dec. 28, 208 eggs
Dec. 18, 15 eggs	Dec. 29, 217 eggs
Dec. 19, 30 eggs	Dec. 30, 221 eggs
Dec. 20, 35 eggs	Dec. 31, 230 eggs

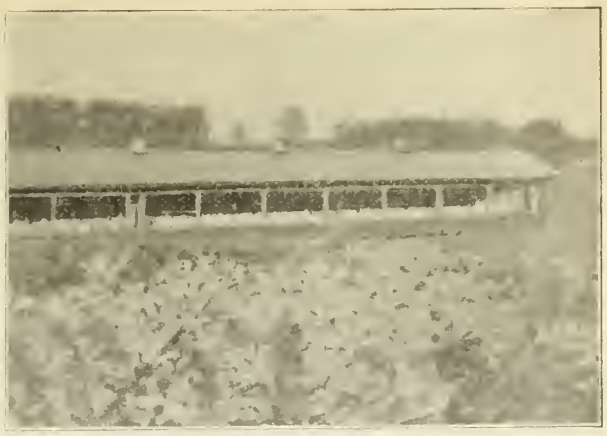
When they reached 215 eggs on the 27th of December the lights were discontinued and have not been used since. Tonight we tested forty-five eggs set under hens and found two infertiles and two doubtfuls, which we consider excellent. Every one knows the price of eggs this winter compared with last summer, but regardless of high or low prices the person who can produce WINTER EGGS has the advantage over the one who gets the largest production in summer.

I want to state here that we have handled our flocks after the methods taught at the Western Washington Experiment Station, which, in our opinion, cannot be beaten.

Yours truly,
(Signed) MRS. T. H. RIDLEY.



PRIVATE ELECTRIC LIGHTING PLANT OF D. P. RAGER



LAYING HOUSE OF D. P. RAGER, IN WHICH LIGHTS WERE INSTALLED.

Letter of E. A. Hammond, Kirkland, Wash.

Editor Reliable Poultry Journal: May 18, 1919.

Complying with your open request in a recent issue, for items on lighting, the following is submitted:

The writer is numbered among those who believe that even the best stock should not be allowed to go beyond a 60 per cent production during the winter months. In this instance, it was the aim of the writer to hold, as nearly as possible, to a 70 per cent production from six months of age to June first. The result is given without comment, other than to say that statements are correct.

Stock: 400 pullets, May 25th hatch. White Leghorns bred by D. Tancred, Kent, Washington.

Housing: Shoup type open front with storm curtain, 20 by 75 feet, not partitioned. Capacity of house would be 500.

Lighting: 50-watt nitrogen lamps every 20 feet. Maximum hours of lighting, twelve. Lighting usually both ends of day, though at times only morning lighting was given. Lights were automatically turned on in the morning, except at such times as there was a possibility of water or the feed being frozen. Dimmers were used at night for fifteen minutes to send the birds to roost.

Feeding: Germinated oats placed in litter at night for morning feed, except when danger of freezing. At 2 p. m., grain. At 6 p. m., mash wet with fresh blood—occasionally semisolid buttermilk. 7 p. m., green feed. Dry mash accessible at all times. Feed consumed per 100 birds per day, not including green feed, shell, grit, etc., 16 pounds of grain and 8 pounds of mash.

Up to March first nine birds had died, apparently from liver trouble induced by overfeeding. On the same date, 67 pullets were in a partial molt. Fifty-five, including part of the molters and those that had stopped laying from other causes, were culled. None have since died, nor have any more been culled out.

The production follows, being given to the nearest unit, and for number of birds on hand at date given:

First egg Oct. 17th.
Production Nov. 25th .....60 per cent.
Production Dec. 25th .....67 per cent.
Production Jan. 25th .....73 per cent.
Production Feb. 25th .....56 per cent.
Production Mar. 25th .....55 per cent.
Production Apr. 25th .....70 per cent.
Production May 25th .....81 per cent.

Daily production seldom varied over twelve eggs from 70 per cent.

Trusting the above may be of some use to you, I am

Yours truly,
(Signed) A. E. HAMMOND.

Early Use of "Lighting System" in Michigan

J. G. HALPIN, PROFESSOR OF POULTRY HUSBANDRY AT WISCONSIN COLLEGE OF AGRICULTURE, WRITES AN INTERESTING LETTER TELLINGOF HIS EARLY EXPERIENCES AND OBSERVATION OF THE USE OF ARTIFICIAL ILLUMNIATION TO INCREASE WINTER EGG PRODUCTION—USED FIFTEEN TO TWENTY YEARS AGO, AND WITH GOOD RESULTS

By PROF. J. G. HALPIN, Head of Poultry Department, University of Wisconsin, Madison, Wis.

THE following letter, written to editor of R. P. J., was not intended for publication, but recognizing its value we wrote the author and asked his permission. Our object, as a matter of course, is to secure and publish all the interesting and helpful data we can, on this important and truly promising subject—"promising" in the sense of placing a profit-earning foundation under the commercial egg plant or flock in many sections of the United States and Canada.—Editor.

The Letter From Prof. Halpin

Madison, Wis., March 17, 1919.

Editor R. P. J.:—

I was very glad indeed to get your letter of March 13th. Am sorry to say that we are not doing anything special in the way of artificial illumination here at the experiment station. I believe that I am the first experiment station worker to be guilty of trying this out on the hens.

JAS. G. HALPIN, MADISON, WIS.

Professor of Poultry Husbandry, University of Wisconsin. Was one of the men first to get on the track of the use of artificial light to increase egg production.

Back in 1906, over in Michigan, we started this and had splendid success with the artificial light as compared with those birds with no light. Our long house in Michigan was especially adapted for that sort of thing, in that the partitions between all pens were solid and we illuminated every other pen after having carefully selected the birds, so that one pen was just about as good as the other at the start, and all that sort of thing.

My records and observations at that time were received with a great deal of amusement by my coworkers who seemed to agree with the daily press at that time that it was a joke. I remember one rather prominent agriculturalist laughingly told me a farmer was not going to go out and hang a lantern in the chicken coop! The only publicity that I got was from one or two daily papers that thought it was a great joke and said I was trying to work the hens to lay two and three eggs a day. I believe the work has been carried on in Michigan at least part of the time since I left there. I have never been able to find the original data which I secured there in Michigan. When the practice began to become more popular, I, of course, was more anxious to secure the records that I left there, but they evidently had been destroyed.

I have frequently recommended this plan to our commercial egg farmers and some of them are trying it out and have been trying it out for years with good success, in fact they would not return to no lighting. I started this illumination proposition entirely with the idea of getting data largely from an extension standpoint. For instance, at that time in Michigan a large per cent of our farmers that took fairly good care of their hens were feeding a wet mash in the morning. It frequently happened that they did not get around to feed the wet mash until eight or nine o'clock, with the result that the hens sat on the roost and waited for the attendant to come with their breakfast. Other observations that I made at the same time showed that during the short days the hens would have practically empty crops by midnight and the theory suggested itself to me that the hen was simply a mill and that she was not equipped for running and manufacturing eggs on the basis of a short day, also that if she was not given her breakfast before nine o'clock in the morning she did not stand a very good show of producing a large number of eggs in a month during the three months of shortest days.

On that account I rigged up an alarm clock device that would turn on the lights a little after four o'clock in the morning and we put feed in the litter in the pens at night, a practice I have followed very commonly the most of my life. When the lights would come on at four o'clock in the morning the hens would immediately get down from the roost and begin working for their breakfast. By daylight I would have more eggs in the nests in the lighted pens than I would get all day from the non-illuminated pens and although I have not the records, I remember distinctly that for November, December and January, on two years' test, we secured more than as many again eggs from the illuminated pens, and ever since then I have been preaching a system of feeding which would give the hen just as long a feeding day as possible under general farm conditions.

To some of our specialized poultry farms I have recommended artificial illumination. We, of course, do not have many farms in Wisconsin which take very much interest in that sort of thing. At the time, I supposed that I had run onto a brand new idea and was a little bit disgusted at the lack of enthusiasm shown by some of my coworkers and others, as hinted above. A little later, however, I found that my idea was about as old as the hills—apparently another proof of the fact that there is nothing new under the sun.

I was up in northern Michigan and there found a man that had been using illumination in his poultry house for years. He discovered it accidentally. He had a poultry house with three or four pens next to his barn in which he kept his horses. His men came to the barn at five o'clock in the morning, fed the horses and cared for them. He noticed that the hens in the first pen laid more eggs than the hens in the other pens; that as soon as the lights were on, the hens in the first pen would get down and go to digging in the straw for something to eat. This made him think that it would be a practical thing to wire his poultry house so that when the men came in to take care of the horses in the morning they could turn on the lights in all of the pens and poultry houses at the same time. The name of this man has escaped me, but I remember that he had been practicing that for severaal years when I talked with him in the spring of 1907 or 1908.

The more modern development of illumination seems to be to furnish light at both ends of the day. I do not know whether there is any special advantage in light both morning and evening or whether the same thing could be accomplished by illuminating a given number of hours all at one time.

Yours very truly,

J. G. HALPIN,
Professor of Poultry Husbandry.

(Note: The foregoing article is reprinted from the May, 1919, issue of R. P. J.)

Results of the Use of "Lighting System" in New Jersey

REPORTS FROM FOURTEEN FLOCKS NUMBERING NEARLY 4,000 BIRDS, COVERING SIX MONTHS, FROM SEPT. 1, 1918, TO MARCH 1, 1919, AND EMBRACING BACK-YARD FLOCKS, GENERAL FARM FLOCKS, AND COMMERCIAL EGG PLANTS—RESULTS WERE A DOUBLING OF THE EGG PRODUCTION, AND FOUR TIMES GREATER RETURNS OVER COST OF FEED AND LIGHTS—SEASON FOR LIGHTING AND HOW TO USE THE LIGHTS—WHAT TO FEED—HOW MUCH AND WHEN TO FEED FOR BEST RESULTS

Report by EDITOR

PREVIOUS to our recent visit to New Jersey we had written Harry R. Lewis, Professor of Poultry Husbandry, of the New Jersey State Agricultural College, asking him what had been done in New Jersey in the way of testing the use of artificial illumination during the short-day time of the year (fall and winter) to increase egg production during what is known as "the period of scarcity and high prices." Prof. Lewis replied that considerable in this line had been done in Ocean County, including the Toms River and Lakewood poultry districts, and "with very good results"; that Victor G. Aubry, extension specialist of the Poultry Department of the New Jersey State Agricultural Experiment Station, was in charge of this branch of state poultry work and would gladly furnish data and recommendations regarding same for publication in these pages.

HARRY R. LEWIS, NEW BRUNSWICK, NEW JERSEY

Professor of Poultry Husbandry, New Jersey College of Agriculture and Experiment Station. Is one of the up-to-date and progressive students of poultry culture, all branches, and founder of the Vineland International Egg Laying and Breeding Contest, Vineland, N. J., one of the big and worth-while successes in poultry science and development to date. Also author of several poultry books of importance and value.

On visiting the Toms River and Lakewood section (Ocean County) we found several plants using lights, including the Queensbury Farm, E. E. Levy, proprietor; Chas. W. Warner, C. S. Greene, Richard Heinie and others. These men, without exception, reported satisfactory results. In the Vineland district only one plant among the eight we visited had tested artificial lighting. Vineland to date has been slow to adopt the lighting system, but several proprictors of good-sized commercial egg plants in that district told us that they intend to install them next fall. We had several talks with Prof. Lewis about the new method, during which he expressed a very friendly attitude toward "the use of artificial illumination to stimulate egg production" and at our request he furnished us the following statement for publication herewith:

Attitude of the Department of Poultry Husbandry of the New Jersey State Agricultural Experiment Station Toward Artificial Illumination to Stimulate Production

"The Poultry Department of the New Jersey Station has, for the last two years, appreciated in a general way the wonderful results which are sure to come from an intelligent use and application of the principles of artificial illumination to stimulate egg production. We have carried on some small flock preliminary lighting tests. We have avoided the inauguration of any intensive research project on this subject until we can get a proper idea of just what the vital problems are; just where the use of lights might be harmful and in just what fields and under what conditions the use of lights might be questioned.

"We have, in a general way, encouraged the use of lights among commercial poultrymen in the state, and have for the last year some wonderful records showing the comparison of production on lighted and unlighted flocks throughout the state. Mr. Aubry, our extension specialist, has had the details of this work in hand, and I would suggest that you confer with him relative to the results. We are outlining and inaugurating a lighting research project at this station to start September 1st, to include 1,100 birds, 500 pullets and 600 hens. In this project we plan to test the use of lights on slow-maturing pullets. We also plan to test the lights on early-hatched pullets and on late-hatched pullets; also on breeders, likewise on cull hens which go into an early summer molt, and which would ordinarily be disposed of early as nonproductive birds. In this series we shall also study the use of lights on trap-nested pens to determine the effect of same on individual production. This research project will be carried on with the greatest of care. We already have evidence giving us some idea of what to expect in most of the phases of this work, but before bringing out any definite facts for publication in bulletin form we are desirous of reviewing these results and checking them in a larger way, more nearly like what might be expected under average or general commercial conditions.

HARRY R. LEWIS,
"Professor in Poultry Husbandry."

During the last nine years, dating from November, 1912, the Department of Poultry Husbandry of the New Jersey State Agricultural Experiment Station, New Brunswick, has issued monthly a four-page circular, 6x9 inches in size, entitled "Hints to Poultrymen," in which members of the department, in a timely way, convey to the poultry and egg producers throughout the state, valuable data, information and advice. Thanks to the enterprise and progressiveness of Prof. Lewis and the up-to-date and earnest work of Mr. Aubry, R. P. J. is in a position to publish herewith in full the contents of "Hints to Poultrymen" for July, 1919, entitled "Artificial Illumination of Poultry Houses to Increase Fall and Winter Egg Production," together with several diagrams and graphs that were prepared especially for the purpose by Mr. Aubry, assisted by Mr. R. R. Hannas, also of the Poultry Department of the New Jersey College and Experiment Station. An explanation of each diagram and graph will be found in connection therewith, as footnotes. Following is Mr. Aubry's well-considered and valuable contribution on this topic of vital concern to all poultry keepers who are interested in securing increased egg production for the daily market or home table during the months of usual scarcity and greatest value:

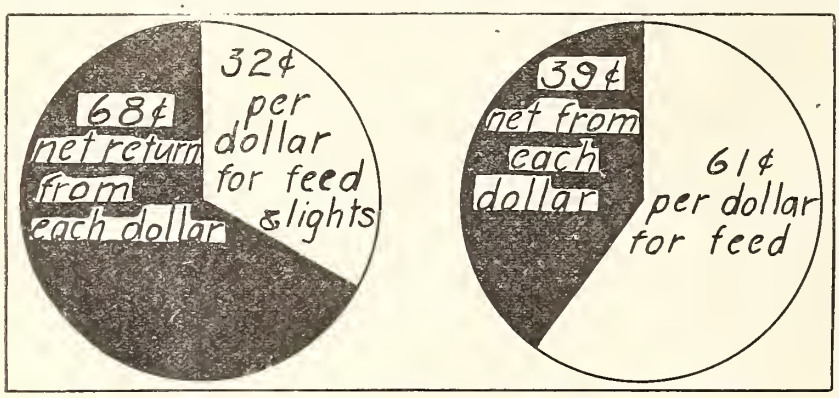
ARTIFICIAL ILLUMINATION OF POULTRY HOUSES TO INCREASE FALL AND WINTER EGG PRODUCTION

By VICTOR G. AUBRY

NOTHING in poultry keeping is being discussed more today than the use of artificial lights in poultry houses for the purpose of shortening the long nights of fall and winter, with the object of enabling birds to feed better and consequently to lay more eggs. At the same time, probably nothing is more misunderstood than the effects or results of this practice. Many have a belief that there is something about the lights that stimulates egg production. This belief is erroneous. The lights are a means to an end, and the real factor, or the cause of the effects on egg production, is a matter of feed. On this point many believe that this means forced feeding. This also is a wrong conclusion, as it is not a case of "pushing the hens to the feed", or of cramming it into them, but simply is giving them the opportunity to consume the amount of feed which they want and which they need in order to maintain a fairly good production during these seasons of naturally low egg production.

Because of these reasons, let us not forget that this practice is in no way a matter of forcing our hens in any manner or form, but instead is a practice which allows the hen more easily and more surely to produce fall and winter eggs which we so much desire and, in fact, which we are almost obliged to get in order to realize the income that we must have.

This circular will deal briefly with the most approved methods of using these lights (at least for New Jersey conditions) on birds which are being "wintered over" for egg production alone, and not for the purpose of breeding. Although the use of artificial lights is being tried on breeding stock and young stock with excellent results to date, this practice on these birds has not developed far enough to warrant, as yet, a general recommendation. But on birds held for egg production alone, its value has been more than satisfactorily proven, time and again; in fact, the results as tabulated near the close of this circular are only representative of hundreds of others all over the country and at a number of Agricultural Experiment Stations. It can be said that it is the rare exception to find results which are negative or adverse to those here given, and the author, although he has seen many flocks so treated and has received and heard of the results of many more, has yet to hear of a single negative result.



HOW LIGHTS INCREASE NET RETURNS FROM THE POULTRY FLOCK

These two circles show the financial benefit of the uses of artificial lighting on fourteen flocks of layers (small and large) in New Jersey, September 1, 1918, to March 1-15, 1919. Where lights were used the egg yield was increased to such an extent (average for the fourteen flocks) that 32 cents out of each dollar of the receipts paid for the feed and lights, leaving 68 cents out of each dollar as "net return" above cost of feed and lights; whereas, if lights had not been used and only the average egg yield for similar flocks "not lighted" (same six months) had been obtained, it would have taken 61 cents of each dollar of receipts to pay for feed, leaving but 39 cents as "net above feed cost" from each dollar of receipts.—Courtesy of Victor G. Aubry, Extension Specialist, New Jersey Agricultural Experiment Station.

Seasons During Which It Is Most Effective

Any time from September 1st until April 1st will be found to be effective in New Jersey. Even in extreme cases where these lights were not used until late in January and in February, the results were effective inside of a week or ten days from the start. Of course, during these seasons, egg production almost invariably is on the rise normally, but the results noted showed a more rapid increase than the normal.

It must not be forgotten that the object is to shorten the long nights of fall and winter, however, and that, therefore the sooner in the season it is started, the better. This is so to the extent that just a few days will mean quite a bit. We find some who would not use lights on pullets until they had started to lay of themselves, with the idea that this would force them to premature production and stunt their development. This is wrong, as a bird will not lay until her body is so developed as to be able to manufacture eggs properly. These lights, however, hasten this development to maturity and in no way are they harmful.

Another idea which often holds up the use of lights early in the fall is the fear that if the birds are started too early in the fall, they will react during the winter, that they will stop laying and often throw a molt. Don't forget that this reaction and molt often happen to flocks which have started late and are no doubt due more to improper feed, to improper growth of pullets or to some adverse condition of weather, than to the fact that they have already laid too many eggs. A few flocks noted in the tabulations which follow are February and March-hatched pullets, and to date those that have not suffered from chicken pox or colds have not let up in their production since last August, having shown no molt, and they are doing fine.

The lights should be started on or soon after September 1st, at least for New Jersey. For the different aged pullets, differences in feeding should be practiced, as is noted later. After March 1st, the effect of lighting is very slight, and for New Jersey conditions their use could well be stopped between the 1st and 15th of March.

Time of Day and Amount of Hours to Use Lights

As far as the birds themselves are concerned, it doesn't seem to matter much during which part of the day the lights are used, although it is sometimes difficult to keep the birds from going to roost while the lights are still burning if used entirely in the evening, especially if run late, after 8:30 or 9:00 p. m., and when lighted late, it often requires a bait method of some kind in the feed, like scratch feed or a warm mash, just before closing time. Very good egg yields, however, have been realized when lights were used all in the evening, also when used all in the morning, and also when used part in the evening and part in the morning. I believe, therefore, that the poultryman on this point may well adapt time of use to his own conditions and convenience.

Although in just which part of the day these lights are used does not seem to be so important, the length of time they are used does very materially affect results, and one should plan his time accordingly so that the birds will get as near as possible a uniform length of day. From 14½ to 15½ hours seems to be the best length of day. This, of course, includes the normal daylight hours. For example, if natural daylight starts at 6 a. m. and darkness comes so the birds go to roost at 7:30 p. m., then either one whole hour of lights should be given in the morning before daylight—that is, at 5 a. m. the lights should be turned on—or an extra hour at night, when the lights should be started at seven-thirty, and shut off at eight-thirty. Otherwise, half of the extra hour should be given in the morning and the other half at night. This would give the birds a total of 14½ hours of daylight. One more hour could be given with good results, but over the 15½ hours has not been found to be good as it seems to tire the birds some and they do not seem to want to make use of it.

Under this system one must gradually vary the time of starting his lights in the morning, or of shutting them off at night, according to the shortening or lengthening of the natural day. Where night lighting is used, some

way of gradually shutting off the lights is generally used so that the birds can see to go to roost and will not find themselves on the floor in the dark on a moment's notice. With electric lights, dimmers or two switches are used, one turning off most of the lights and the other just a few which will allow the birds to see to go to roost. With gasoline lights, they are turned off and most of them take time enough in going out to allow the birds to go to roost. Gas lights are turned down gradually, as also are kerosene lights. When used in the morning, these arrangements of course are not necessary, as the lights in this case are turned on full blast and kept there until natural daylight is sufficient to warrant turning them out. It has been found that with electric lights if one will snap them off and on a few times just before the time to turn them off for good, the birds will of themselves go to roost with full lights on, making it unnecessary to use dimmers, etc. This can be explained by the fact that after the fifteen hours or so the birds are ready to go to roost anyhow, especially if a good scratch feed is given the last thing at night.

The following schedule has given, it seems, the best satisfaction of those tried, especially to the poultryman himself, as it has not interfered with his going to meetings and out on pleasure in the evening:

Starting the lights at 4:30 in the morning, until natural daylight.

Starting lights again as it gets dark in the afternoon (this time varies on dark and bright days) and shutting them off at 7:30 in the evening. Once the natural day has gone over this time the lights may be discontinued.

These hours are given on the "old time" schedule and not in accordance to the new daylight-saving schedule as used during the last two years.

When the lights are used either all in the morning or all at night it makes it quite inconvenient to the poultryman during December and January, especially when the days are extremely short as it obliges him to either start lights around 3 a. m. or to stay up around 10 p. m.

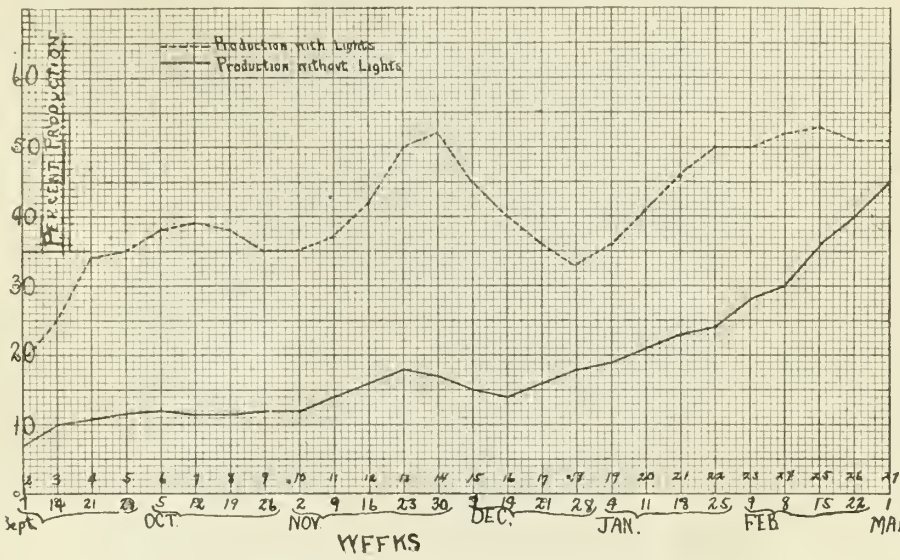
Kind and Amount of Light

Any kind of light from kerosene to electric light has been found all right, provided the birds have no difficulty in seeing. The electric light, it goes without saying, is the most convenient and least dangerous as to fire, and in most cases is as cheap as any in the end, although where electric lights are not obtainable, some of the types of gasoline lamps have given excellent satisfaction and are cheap to run. Most of them are safe from fire danger, having been underwritten by fire insurance companies. The prices of these lamps run from five to fifteen dollars each. Ordinary kerosene lanterns, if enough are used and if a good reflector is placed back of them (and of course if kept clean), have done well. One should not ignore this system or turn it down because of difficulty in getting lights. The cost of the gasoline lantern is made up many times in a short while by the extra returns on eggs, and some poultrymen, during the past year, have even more than paid for the installation of one of the farm electrical units costing about $400.00, doing this on extra eggs alone, and before the season was quite half over.

The light that corresponds to a 40-watt electric lamp is the least that should be used for about 100 birds, and 80 or 90 watts or even more will be found still more profitable. Usually one of the gasoline lanterns and four or more of the barn lanterns with reflectors will do, although here again more is better than less.

Feeding Birds Under Lights

Feeding under this system is very much the same as it is under ordinary management, but nevertheless there are certain important details that should be observed, which will help a great deal to make this system more successful. As stated before, the significant factor which affects our birds is one of feed. During the short days and especially the long nights, which are on the increase until the latter part of December, a large majority of our birds get very little more feed than enough to maintain body heat, to rebuild broken cells and to function properly the various organs. Consequently, of course, they have difficulty in producing eggs, and it may be said that some do not even get sufficient food for maintenance, which condition causes a large proportion of our winter troubles. Some hens, as shown by the trap nests, are heavy winter layers, often laying as many eggs during the six months of fall and winter as they do during the balance of the year, and doing this without lights. This condition is explained by the fact that these hens are exceptionally



RESULTS OF USE OF "LIGHTING SYSTEM" IN NEW JERSEY

This graph or diagram illustrates Table on page 74. It shows results of lights on 3,940 birds, "kept in 14 different flocks and cared for by 14 different poultrymen," from September 1, 1918, to March 1-15, 1919, as reported weekly to the State Poultry Department, New Brunswick. Per cent of production is shown in left-hand column of figures. Dotted line shows actual production, week by week, made by the fourteen flocks under lights, while solid black line shows average production during the same period by practically 10,000 birds in New Jersey, kept under similar conditions but without lights, as reported at regular intervals to the Poultry Department at the Agricultural Experiment Station. Reports received, figures compiled and this graph made by (or under the direction of) Mr. V. G. Aubry, Extension Specialist, Poultry Department, New Jersey State Agricultural Experiment Station.

efficient utilizers of food material and waste, so that they pass off a minimum amount of food in the droppings. Such hens are exceptional. As shown by the average low-flock production during these seasons, the average hen wastes or passes off in her droppings much more food material, thereby not using efficiently the short ration which she must necessarily get during the season of long nights. This means that the average hen does not get sufficient nutrition to manufacture eggs during the fall, and especially during the winter.

As is true of other animals, no two hens assimilate feed in the same degree of efficiency, and there is also, no doubt, a wide variation as to the actual amount of nutrition necessary for maintenance in different hens. The size of the hen, and without doubt numerous other factors, influence this character. So the natural winter layer is the hen that so efficiently utilizes her feed as to allow her enough of a surplus over maintenance TO MAKE EGGS, whereas the average hens are only able during these seasons to maintain themselves, with the same opportunity to get feed.

The artificial lighting, therefore, will only affect the extra good hen in so far as it gives her more opportunity to stay within the amount of food she needs, for even such hens, without doubt, are often close to the edge of starvation as far as egg production goes and un-

der such conditions will fall off in production when weather conditions are unfavorable. Lights, therefore, will not affect such a hen's production much. But this system is most effective on the average and poorer hens, as it gives them the chance to get the surplus feed needed for egg production. It accordingly then does not force them, but gives them the opportunity which they seek.

The Rations To Be Used

Scratch feed (parts by weight)

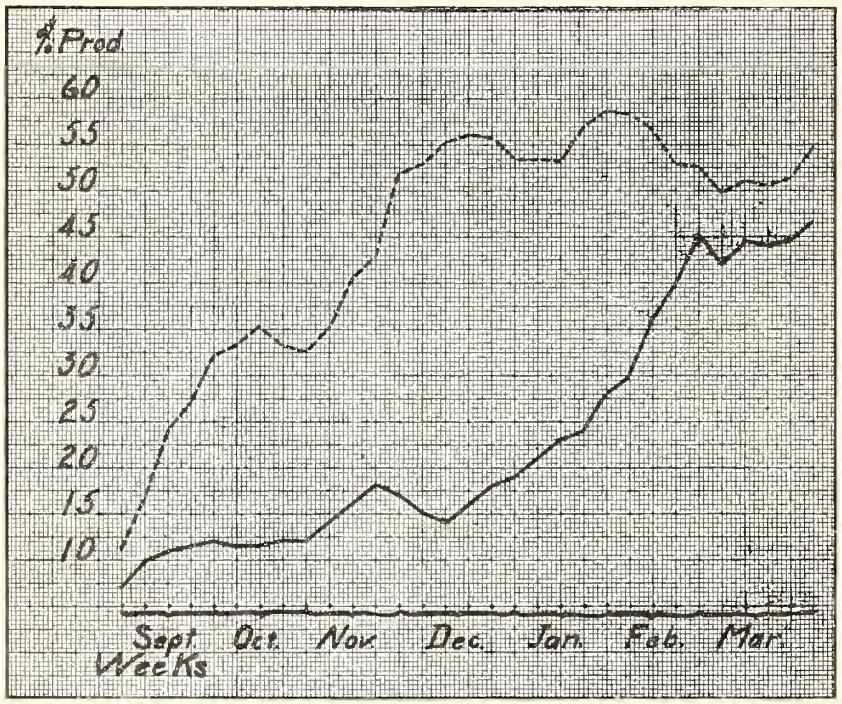
Cracked or whole corn	2
Wheat	1
Oats	1

Mash feed (parts by weight)

Wheat bran	1
Wheat middlings	1
Corn meal	1
Ground oats (heavy)	1
Meat scrap or fish scrap (high grade)	1

The mash feed should be fed dry and in boxes or self-feeders kept constantly before the birds and available to them at ALL times. This system of feeding mash may be supplemented by feeding the same mixture wet and given during the middle of the day. But only enough wet mash should be given so that they will clean it up in half an hour at most. (This is important, as they usually get sick of wet mash if it is left before them any longer.)

The scratch feed should be given at least three times daily and in cold and disagreeable weather may well be given four times. The amount of mash the birds will eat will be influenced greatly by the amount of scratch feed given, as they will consume a large part of their daily ration in the form of scratch feed if enough is given. Therefore, only a small part of this scratch feed should be given in the morning, thereby making the birds hungry for mash. The scratch feed given in the morning is more for the purpose of exercise than anything else, and it will be found that they will work and scratch as hard for one pound of scratch as they will for ten pounds. When given too much, they will only eat that which they find on the surface of the litter and then will be more or less satisfied and will not dig for the part that sifts to the floor.



A GRAPHIC COMPARISON OF THE RESULTS SECURED IN LIGHTED AND UNLIGHTED PENS

The interested reader, on noting illustration on page 73, naturally will wonder why there was a decrease in egg production under lights the last two weeks of October and the first week of November, 1918; also from December 1st to the middle of January following. This was caused by chicken pox in several of the 14 flocks, which affected the pullets in October-November and both the hens and pullets in December-January. Above diagram shows the egg production (dotted line with lights and solid line without lights) during the same six months, as made by three of the fourteen flocks that did not have chicken pox. Note the much larger yield proportionately of these three flocks (on a percentage basis) and their consistent production "under lights." For further details, see article on the opposite page, entitled "Further Facts About Use of 'Lighting System' in New Jersey."

A good big feed of scratch should be given at night, because if they can be made to go to roost with a crop full of scratch feed, it will last them through the night much better.

Schedule for Feeding Scratch Feed

Pounds per 100 birds

	Early A. M.	10 A. M.	Noon	Late P. M.	Total
September	3	..	2	5	10
October	3	..	2	5	10
November	3	..	2	5	10
December	2	2	2	6	12
January	2	2	2	6	12
February	3	3	2	5	10

When this is supplemented with a wet mash it is best to give the mash just after noon. Following this schedule will be found to induce birds to work pretty well all day, and will do away with a great deal of the inactivity which is apt to develop during cold and bad weather.

On late-hatched pullets this schedule of feeding scratch feed should begin just before it is expected the birds will or should come into laying, or after a few eggs are found in the pens. Before this time, for about three weeks to a month, these pullets should be fed quite heavily on scratch feed. This will enable them to come into production with a good reserve of fat and in good condition, a matter which is quite important for the steady winter egg production. By heavy scratch feeding is meant from 12 to 14 pounds daily per 100 birds, about half in the morning and the other half at night.

The results (see table) show a little bit less than double egg production due to lights and when eggs are figured in dollars and cents they show four times the net returns over the cost of feed and lights in the lighted pens.

These flocks showed much better condition of health, etc., as a whole, than did the birds not under lights, and although in most pens the lights were discontinued by April 1st, these hens are laying today (June 1, 1919) about the same number of eggs as the birds which have not been under lights.

The practice of artificially lighting hen houses has shown beyond a shadow of doubt that it will materially increase fall and winter egg production and has very little, if any, influence on the egg production which follows during the spring and summer. It has also shown that it is not a forcing or so-called "burning up" of the hens, but is rather giving the hens an opportunity to do what they should do and that which they seem to be anxious to do.

The following tabulations are the results of lights on 3,940 birds taken in New Jersey. These birds were kept in 14 different flocks and cared for by 14 different poultrymen. These flocks are located in north, central and south Jersey and include flocks from general farms as well as city back-yard flocks and commercial poultry farm flocks.

TABLE SHOWING RESULTS OF THE USE OF LIGHTING SYSTEM IN NEW JERSEY

	Sept. 1918	Oct. 1918	Nov. 1918	Dec. 1918	Jan. 1919	Feb. 1919	Total
No. of flocks	14	14	14	14	14	14	14
No. of birds	3940	3940	3940	3371	3878	3745	3802
No. of eggs	35463	45190	53188	39771	52896	54003	280511
Per cent. production	30	37	45	38.06	44	51.5	41
Av. for state where no lights were used	26	13	15	20.4	25	33.3	22
Inc. egg production due to lights	5051	30312	35458	15686	22601	18050	127158

Note that there is a variation as to the number of birds. This was made necessary as some owners were late in making their returns. In fact, in some cases it was necessary in order to get the monthly records, to copy them from the poultrymen's daily production.

(Note: The foregoing article is reprinted from the July, 1919, issue of R. P. J.)

Further Facts About Use of "Lighting System" in New Jersey

ACTUAL CASES IN FORM OF DAY-BY-DAY REPORTS, SHOWING HOW MUCH BETTER PULLETS AND HENS LAID "UNDER LIGHTS" THAN OTHER SIMILAR FOWL DID UNDER SAME CONDITIONS BUT "NOT LIGHTED"—WHERE NOT CUT DOWN IN PRODUCTION BY CHICKEN POX, THE LIGHTED BIRDS LAID ABOUT TWO AND ONE-HALF EGGS TO THE OTHERS' ONE—REMARKABLE YIELD UNDER LIGHTS OF TWO COMMERCIAL FLOCKS OF YEARLING HENS DURING LAST DECEMBER, JANUARY AND FEBRUARY

Report by EDITOR

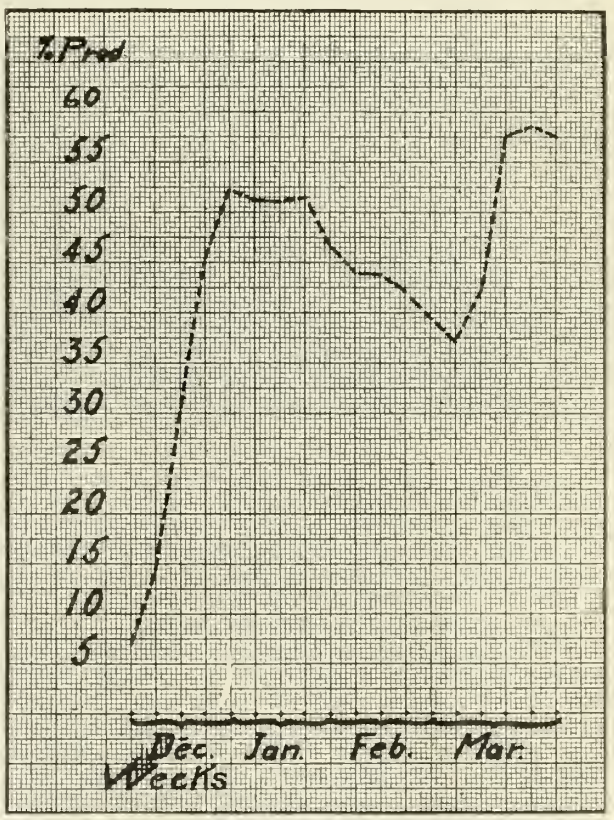
TO a great extent the financial value to poultrymen of the use of artificial illumination during the short-day period of each season (September 1st to the following March 1st or April 1st) depends on the amount of increase in egg production thus secured, as compared with results from the same kind of fowls kept in the same locality under substantially the same conditions, but without the use of artificial lighting. In this connection, note the graph on page 73, the dotted line in which shows actual production on a percentage basis of fourteen flocks "under lights" numbering practically 4,000 birds, as compared with about 10,000 birds that were not "under lights." All these birds were S. C. White Leghorns. Asked by editor of R. P. J. about the 10,000 birds (using round numbers), Mr. Victor G. Aubry, extension specialist of the Poultry Department at the New Jersey Agricultural Experiment Station, said, in substance:

"This was the actual production, as shown by percentages, of about 10,000 birds in our state during the same months (September 1, 1918, to March 1, 1919, inclusive), which average production was confirmed by nonlighted pens on the same fourteen plants that tested the lighting system and gave weekly reports on the results thereof."

The actual average production for the fourteen lighted flocks, as given by Mr. Aubry (see table on page 74), entitled, "Results of the Use of Lighting System in New Jersey", was 41 per cent, while in the same table Mr. Aubry gives the "average for state where no lights were used" as 22 per cent. From other records on file in the poultry department of the New Jersey Agricultural Experiment Station it was learned by us that the monthly egg production on a large number of New Jersey commercial egg plants without lights, September 1st, 1917, to March 1st, 1918, (one year earlier) was: September, 24 per cent; October, 12 per cent; November, 14 per cent; December, 18 per cent; January, 20 per cent; February, 33 per cent, or an average of twenty and one-sixth per cent for the six months, representing the short-day period of the year. Please keep these averages in mind.

Attention at this point is directed to the graph on page 73 as compared with the production (on a percentage basis) shown by graph on page 74. What we are considering in this article or report is the VALUE of the lighting system, as compared with "no lights." We asked Mr. Aubry for an explanation of the falling off in egg production "under lights" on the part of the 4,000 birds during the last two weeks of October and the first week of November, 1918, also from December first to the middle of January following, as shown so clearly in graph on page 73. He stated that this was mainly (in fact, almost wholly) on account of two temporary epidemics of chicken pox, one that affected the pullets in particular during the latter part of October and forepart of November, and another that affected both the pullets and hens during December and the forepart of January. Asked if all the fourteen flocks were thus affected, he replied in the negative, stating that the severity of the attack varied with the different flocks and that three of the flocks were not affected at all.

The graph on page 73 shows the production of the three flocks that were not affected by the chicken pox and also shows much more consistent laying, so to speak, under the effects of the lighting system, because, according to the best knowledge to date, the dotted line of increased production as shown on page 73 (for example)



USE OF "LIGHTING SYSTEM" IN NEW JERSEY

Among the fourteen flocks covered by the reports made to the New Jersey State Agricultural College (see Table on page 74) were two flocks of yearling hens, one consisting of 446 birds and the other of 556. Above diagram or graph shows the remarkable results of the use of lights on these 1,002 hens in their second year of production. To appreciate the cash benefit to the poultryman who looks to market eggs for his principal receipts—the benefit to him as compared with "no lights" in the same latitude and under similar conditions, note the comparatively low production, week for week, "without lights" as shown on page 73.

ought not dip down as it did about November 1st, also late in December, but should continue in the form of a quite regular curve from the production of September 1st to the production that should be obtained March 1st, this later production to be well up toward 55 to 65 per cent. Unusual or severe changes of weather may be expected to cause moderate variations as shown in the dotted line, also in the solid black line on page 74, but these variations, in the absence of some affliction like chicken pox, ought not be as great as those in illustration on page 73.

Two facts in particular are emphasized by graph on page 75: first, the remarkably good results obtained dur-

ing the winter months—December, January and February—from yearling hens under lights, as compared with the usual production of hens not under lights (this winter production averaging in the state of New Jersey about 20 to 22 per cent); and, second, it shows also the effect of the attack of chicken pox on these yearling hens, from which they suffered to an extent during late February and early March. According to statements made to us by poultrymen in New Jersey, also by Mr. Aubry, an attack of chicken pox, temporary in effect, and lasting three to four weeks, may be expected to cut down the egg production of a flock 15 to 20 per cent and this is true whether or not the birds are under lights. As a matter of course, in our efforts to determine by actual tests the comparative value of the use of artificial illumination to increase winter egg production, or production during the short-day period of each season, including the fall months, we are entitled to eliminate, so far as we can, the adverse effects of poultry ailments, such as chicken pox in this case.

To get a good general idea of the benefits of the lighting system in the form of increased production, as represented by percentages, let the reader keep in mind that practically 10,000 S. C. White Leghorns in New Jersey last fall and winter (September 1, 1918-March 1, 1919) averaged to lay about 22 per cent of eggs (a comparatively mild winter), whereas, during the last four or five years the comparatively well-managed commercial egg plants of New Jersey have averaged for September, October, November, December, January and February, only twenty and one-sixth per cent. It follows then, that whatever excess above this twenty and one-sixth per cent and 22 per cent a considerable number of these fourteen "lighted flocks" produced during the same six months of last season, may be regarded as largely due to the lights, and the same is true of the profits therefrom, except that the increased production required more food, and the cost of the lights also is to be considered.

Added Cost of Feed and Lights

With regard to the increased cost of feed, Mr. Aubry reported that the feed for the 3,940 birds that laid 280,511 eggs (see table on page 74) actually cost, as per reports furnished him, $5,910.00, whereas an equal number of birds not under lights, consumed in the same period, $5,082.20 worth of feed. This difference is not great, in fact, it is surprisingly small. Asked about the average cost of "lights" in New Jersey, Mr. Aubry said:

"It has been rather hard to estimate the cost of lights, especially since all kinds of lights have been used, from kerosene lanterns up to electric lights; also because in some cases more than twice as much light has been used as in others. However, basing our estimate on reports given us by operators, this cost has averaged about one cent a month per bird for the six months, making an extra cost of six cents per bird for the use of lights during a six-month lighting season. This figure, so all the record keepers have agreed, amply covers the cost of lighting, including electric lights, gasoline lamps and kerosene lanterns, not taking into account the question of labor in caring for the different kinds of lights."

Keeping in mind the New Jersey averages herein given for nonlighted flocks (20 1-6 per cent and 22 per cent) let us compare same with ACTUAL egg yields obtained by half a dozen or more of the fourteen New Jersey poultrymen who made monthly reports to the Poultry Department of the Agricultural Experiment Station during the time they were testing "lights." Said Mr. Aubry:

"You would be interested to get acquainted with some of the men who have been keeping these records. Take for example, Mr. Richard Heinie who is one of the pioneer poultry keepers in the Lakewood section. He is a man who has put quite a bit of study into his poultry work, and, because he was one of the beginners in that district, his neighbors have a great deal of confidence in his teachings and the results obtained by him. His son, Henry Heinie, who is located on a place immediately adjoining his father's, is likewise putting a good deal of thought into his poultry work. Both of these men depend entirely on poultry for their livelihood. You will be interested to know that Mr. Henry Heinie, when he started to test lights, used gasoline lanterns to light his pens until he had the opportunity to install electric lights, and he states that, although the electric lights are a good deal more convenient and easier to take care of, the gasoline lights seem to give just as good results so far as the birds are concerned, including the increased egg yield. This bears out the reports of practically all the men in the state with whom we have been in touch. That is, that just as long as the birds have light AND A SUFFICIENT AMOUNT OF IT it seems to make no difference what source it comes from, but the electric lights, of course, are much more convenient to poultrymen."

Following is the egg production that Henry Heinie obtained from the use of lights on the percentage basis, from 172 March-hatched pullets and 578 April-hatched pullets, given by weeks, Sept. 1, 1918, to March 1, 1919:

September 1-7, 20.5 per cent; September 8-14, 30.8; September 15-21, 46; September 22-28, 45; September 29-October 5, 51; October 6-12, 48; October 13-19, 53; October 20-26, 47; October 27-November 2, 43; November 3-9, 42; November 10-16, 48; November 17-23, 48; November 24-30, 58; December 1-7, 53; December 8-14, 49.5; December 15-21, 51.5; December 22-28, 54.5; December 29-January 4, 55; January 5-11, 52; January 12-18, 61.8; January 19-25, 53.5; January 26-February 1, 54.5; February 2-8, 54; February 9-15, 51; February 16-22, 43; Feb. 23-March 1, 43.5.

From December 1, 1918, to April 1, 1919, Richard Heinie obtained the following weekly percentages from 556 hens under lights:

December 1-7 (lights turned on December 1st) 9 per cent; December 8-14, 15; December 15-21, 36.5; December 22-28, 53; December 29-January 4, 57; January 5-11, 55; January 12-18, 55.8; January 19-25, 56; January 26-February 1, 56.5; February 2-8, 57; Feb. 9-15, 55; February 16-22, 50; February 23-March 1, 46; March 2-8, 40; March 9-15, 51.5; March 16-23, 57.5; March 23-30, 58.3.

Extra Eggs Soon Paid for Electric Lighting Plant

Referring to his reports and records, at the time of this interview, Mr. Aubry said further:

"You would also enjoy visiting the poultry plant of Mr. A. B. Faure, who was a beginner in this work about two years ago. He is truly progressive and always ready to adopt any new method or system that has proved to be beneficial. Mr. Faure not only has tried this system on his pullets the past fall and winter—446 of them—but he had the courage to keep lights on his hens, including those he used as breeders. Mr. Faure's farm is located in the northern end of Cape May County, which is the extreme southern county of New Jersey.

"In Mr. Faure's section of Cape May the land is very light and unless given the best of care, is not very productive. For this reason Mr. Faure was able to buy his farm at a low figure and he has kept the building cost down to the minimum. He has on his farm, the capacity to 'winter over' about one thousand birds and his outlay was less than $3,000.00, or a little less than $3.00 per bird and when figuring the cost of the birds themselves at $1.50 each, this makes his outlay for the entire 1,000-bird poultry plant about $4,500.00. I quote Mr. Faure when I say that he has more than made up, on the EXTRA EGGS received from the use of lights, for the cost of installing a farmer's electric lighting plant, which cost him over $400.00. This he did on a comparatively few birds—just short of 900. Additional to the pullets mentoned, 'he kept over' about 440 hens. This is one of three poultrymen in New Jersey, known to me, who have paid, this last season, for the installation of an electric lighting system, doing so on the extra eggs received from their birds under lights."

From the 446 pullets carried through last fall and winter by Mr. Faure and placed under lights, he obtained the

following yield, week by week, as expressed in percentages, September 1, 1918, to March 1, 1919:

September 1-7, 24.6; September 8-14, 41.4; September 15-21, 55.5; September 22-28, 62.2; September 29-October 5, 54.5; October 6-12, 56.5; October 13-19, 50; October 20-26, 52.5; October 27-November 2, 52; November 3-9, 37; November 10-16, 47; November 17-23, 39.5; November 24-30, 37; December 1-7, 38.2; December 8-14, 41.6; December 15-21, 48.3; December 22-28, 54.1; December 29-January 4, 56.2; January 5-11, 57.1; January 12-18, 53.4; January 19-25, 54.3; January 26-February 1, 51.8; February 2-8, 52.6; February 9-15, 54.5; February 16-22, 52.4; February 23-March 1, 50.4.

December 1st to March 1st, from an equal number of hens placed under light (446), Mr. Faure obtained the following yield, as stated in percentages:

December 1-7, 5; December 8-14, 13.5; December 15-21, 24; December 22-28, 36.5; December 29-January 4, 47; January 5-11, 47.5; January 12-18, 46.5; January 19-25, 47; January 26-February 1, 37; February 2-8, 31; February 9-15, 32.5; February 16-22, 34.5; February 23-March 1, 34.5.

Our readers in general will be interested in the fact that the temperature in central New Jersey goes down to about 10 degrees above zero in midwinter, while farther north in the state it sometimes drops to zero for a day or two, or a few hours.

NOT UNUSUAL THESE DAYS TO HAVE 200-EGG FLOCKS

The 300-egg hen and the 200-egg flock (average per hen) are now at hand—no doubt about it, and this without the use of lights, though "lights" will make 200 to 300-eggers of many a hen that otherwise could not reach these high records of production and also will bring pens and flocks to the 200-egg per hen average and better. Illustrated herewith is a pen of ten S. C. W. Leghorns that laid 2,114 eggs during their pullet year in the Vineland Contest (New Jersey), or an average of 211.4 eggs per hen. Their individual yield was: 246, 290 (second highest hen in contest of 1,000 layers), 169, 218, 199, 158, 192, 218, 178 and 222, with 24 "out eggs", the latter meaning eggs laid during the year by this pen, but not in trapnests. Picture happens to be of the fourth highest pen in contest. The first highest laid 2,212 eggs, an average of 221 eggs per hen; the second highest, 2,172 eggs, an average of 217 eggs per hen. Record of third highest pen was not available.

Again referring to his records, Mr. Aubry said:

"Here are the reports of Mr. Fred Naylor who lives in the western part of Monmouth County. He is another beginner who has used artificial illumination in his houses with surprising results, although he attributes a good deal of his success, as regards his first winter's production, to the good stock he obtained and to the fact that he grew his young stock on a range where poultry never before had been kept, yet he credits most of his phenomenal fall and winter egg production to the fact that he used lights."

Following is Mr. Naylor's production from pullets, the flock consisting of 840 birds, on the average:

September 1-7, 12; September 8-14, 17; September 15-21, 24.3; September 22-28, 37; September 29-October 5, 39; October 6-12, 43.4; October 13-19, 44.6; October 20-26, 45; October 27-November 2, 44.1; November 3-9, 41.4; November 10-16, 40.3; November 17-23, 40; November 24-30, 45.4; December 1-7, 46; December 8-14, 53; December 15-21, 56; December 22-28, 62; December 29-January 4, 64.3; January 5-11, 60; January 12-18, 58.9; January 19-25, 59; January 26-February 1, 61; February 2-8, 62; February 9-15, 60.1; February 16-22, 58; February 23-March 1, 56; March 2-8, 51.5; March 9-15, 52.

Two General Farmers Who Tried "Lights"

Continuing, Mr. Aubry said:

"Also here are reports from two general farmers. I refer to John H. Miller and to Wm. Wilson, both located in the western part of New Jersey along the Delaware river. They raise poultry as an important side line. This is especially true of Mr. Miller, who carries about 600 birds. Apples are his main crop. Both of these men, however, have realized the importance of poultry when properly cared for and, therefore, are giving their hens the opportunity they ought to have. After having used the lights this last winter on their flocks, they have become more enthusiastic than ever in regard to poultry keeping and in future will make this work what might be called 'a main side line' on their general farms. Both of these men used gasoline lanterns to light their pens."

Mr. Miller's egg production from 600 S. C. White Leghorns (we do not know the proportion of pullets and hens) September 1, 1918, to April 1, 1919, was as follows:

September 1-7, 8.1 (lights turned on September 1st); September 8-14, 11; September 15-21, 14; September 22-28, 16.2; September 29-October 5, 20.3; October 6-12, 20; October 13-19, 21.8; October 20-26, 23; October 27-November 2, 24.5; November 3-9, 28.7; November 10-16, 30.8; November 17-23, 35.4; November 24-30, 43.4; December 1-7, 48.6; December 8-14, 54.4; December 15-21, 56.8; December 22-28, 58.4; December 29-January 4, 54.1; January 5-11, 52.4; January 12-18, 54; January 19-25, 53.2; January 26-February 1, 59.5; February 2-8, 57.3; February 9-15, 54.1; February 16-22, 56.3; February 23-March 1, 52.4; March 2-8, 53.4; March 9-15, 51.4; March 16-22, 48.6; March 23-March 30, 53.4.

Mr. Wilson, the other general farmer referred to by Mr. Aubry, who kept 200 S. C. White Leghorn pullets, obtained the following production, September 1, 1918, to April 1, 1919—lights turned on September 1st:

September 1-7, 5; September 8-14, 8; September 15-21, 12; September 22-28, 20; September 29-October 5, 25; October 6-12, 32; October 13-19, 31.5; October 20-26, 30.3; October 27-November 2, 30; November 3-9, 35.3; November 10-16, 43.2; November 17-23, 47.1; November 24-30, 54.3; December 1-7, 57; December 8-14, 62; December 15-21, 61.2; December 22-28, 56,1; December 29-January 4, 51.3; January 5-11, 56.1; January 12-18, 58.1; January 19-25, 63; January 26-February 1, 68; February 2-8, 61.2; February 9-15, 62; February 16-22, 61.5; February 23-March 1, 58; March 2-8, 56; March 9-15, 53; March 16-22, 54.1; March 23-30, 52.3.

Said Mr. Aubry, in conclusion:

"It is but right to state that in New Jersey this past fall and winter, I have known of only one case in which there was disappointment in the use of lights. In that case everything was going fine until the owner of the flock decided if 'more light' was good, then still more ought to be better, so the hens were kept at work or off the roosts for about eighteen hours out of the twenty-four, with the result that pretty soon they went all to pieces, so far as production was concerned. Twelve to fifteen hours per day appears to be all the birds will stand and do well, judging by prolonged tests and reports in this state to date."

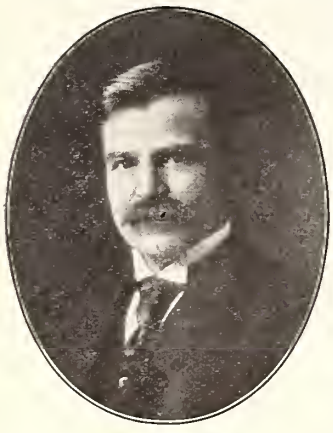
(Note: The foregoing article is reprinted from the July, 1919, issue of R. P. J.)

General Lecture on Great Benefits of Use of Artificial Lights

IMPRESSIVE AND CONCLUSIVE LECTURE BY PROF. JAS. E. RICE OF THE NEW YORK STATE COLLEGE OF AGRICULTURE, AS DELIVERED BEFORE THE SECOND ANNUAL JUDGING AND BREEDING SCHOOL, CORNELL UNIVERSITY, WEEK OF JULY 7-12, 1919—DESCRIBES THIS METHOD, THIS DISCOVERY, AS BEING "SENSATIONAL," IN FACT "REVOLUTIONARY" AS REGARDS BENEFITS TO POULTRYMEN FROM INCREASE IN EGG PRODUCTION DURING FALL AND WINTER MONTHS WHEN HENS "WITHOUT LIGHTS" LAY BUT POORLY, THE RESULT BEING THAT NEW-LAID EGGS THEN ARE HIGH IN PRICE—"NOTHING MARVELOUS ABOUT IT" SO STATES PROF. RICE—PRESENTS TABLES COVERING CAREFULLY MADE TESTS AT COLLEGE EXPERIMENT STATION DURING YEAR 1918

By JAS. E. RICE, Professor of Poultry Husbandry, New York State College of Agriculture, Cornell University, Ithaca, N. Y.

THIS Judging and Breeding School is held annually by the Poultry Department of the New York State College of Agriculture, Ithaca, N. Y., which is conducted as part of Cornell University. The School is attended by poultry instructors and investigators from all parts of the United States and Canada, by poultry extension workers in different states and by other students of poultry culture, all branches. The subject of Prof. Rice's address was, "The Influence of Illumination On The Characters Indicating Laying Capacity of Fowls," but in this first effort he did not reach that subject, so deeply interested was he in the whole proposition. At a later session of the School he handled particularly the subject here stated—see page 83 of this book. It was in connection with this address that Prof. Rice used the ten charts that are reproduced in colors on pages 6 to 15 inclusive, herewith. Accompanying report was made by editor of R. P. J. and published in the Reliable Poultry Journal of date, October 1919. Speaking without notes and treating of the general use of "lights," Prof. Rice said, in substance:



JAS. E. RICE, ITHACA, N. Y.

Professor of Poultry Husbandry, New York State College of Agriculture, Cornell University, Ithaca. Has devoted the active years of his life to Poultry Culture, holding his present position sixteen years or more. Prof. Rice has done much for the Poultry Industry, all branches.

"Here we come to one of the most important of all methods in securing egg production. Of first consideration is the environment of the birds as prospective layers. We must house, feed and care for them in such manner that they can respond in the form of liberal production. Next, is control, by which is meant so to treat or handle the layers that we can get eggs when we want them—that is, at times when they will be of most value to us.

"Heretofore we have depended on the time of hatching, method of feeding, style of houses, etc., to increase egg production in the fall and winter or during the period of natural scarcity in this northern latitude, hence the period of high prices; but in these efforts we have met with only moderate results. For many years I have felt that if we could give our fowls what may be called hothouse conditions, as used for example by the florist, we could get eggs any time we want them—any time of the year. Lately, two great contributions have been made to the method of securing more profitable egg production. One is the successful culling out of nonlayers and poor layers from our flocks by the use of external characters and physical examination; the other is by the use of artificial illumination to increase the length of day during which the would-be layers, the ready-to-lay birds, can function and produce.

"The principles involved in our use of artificial illumination are not mysterious. On the contrary, they are quite self-evident and easy to understand. For example, it is easy to realize that the domestic hen, when kept in this locality, meaning central or northern New York, is out of her natural habitat and she is held here in what amounts to captivity. This fact hardly needs discussion. We know that the original domestic fowl was a native of the tropical zone and climate. For centuries, for ages, she was accustomed to practically a twelve-hour day and a twelve-hour night, on the average. These birds, having been developed under those conditions possessed organs that were based on at least twelve hours of daylight, meaning in particular their digestive organs. Man picked up these fowls and carried them north to points like Ithaca, N. Y., where during five or six months of the year they have, on the average, a nine-hour day and a fifteen-hour night, also vice versa.

"When brought north, these fowls were limited in choice as to what to do. About the only chance they had was to go on functioning the best they could and, as time passed, to adjust themselves slowly to the changed conditions of climate, length of day, etc. Such adaptations mean slow progress. Springtime breeding was continued, with little or no attention to winter egg production. These birds from the south simply adopted new habits, but did not change their physical form. When winter arrived, with the long cold nights, they tucked their heads under their wings and ceased to lay till spring came with its longer days and warmer weather. They just hibernated or practically so, and waited for more favorable conditions.

"First—and until recently—man relied mainly on feeding and special breeding to get these hens to lay in the fall and winter. Good housing and proper feeding will help, also breeding for egg production, based on vigor, high individual records, etc., but the response to all these efforts was not enough—did not make the keeping of layer-flocks on a commercial basis a profitable venture during the short-day period of the year, from September 1st to the following March 1st, taking the North Temperate Zone as a whole.

"Are Astonishing" and "Truly Revolutionary"

"Now we come to this recent use of artificial lights to lengthen the workday of the hen or to equalize her time of work and time of rest in each twenty-four hours and the results are astonishing—are truly revolutionary. They promise great things for the poultry industry on commercial lines and may well cause the speculators in storage eggs to 'sit up and take notice,' to use a common expression. Not only are commercial plants to be greatly helped, but the benefits of this use of artificial illumination apply proportionately to farm flocks kept for egg production and can be utilized in the small back-yard plant where a main object is to secure a liberal yield for the family table in the season of high prices. These remarkable results, however, need to be approached with a degree of caution, especially by investigators who are relied on for constructive facts and sound advice. What this remarkable innovation may do in the case of the breeding values of our best birds, remains to be demonstrated. In other words, we have here a breeding problem as well as one of quantity of illumination and increased egg production."

At this point Prof. Rice exhibited a series of ten charts, all in colors and each representing the yearly egg production of twenty-five S. C. White Leghorns. Two of the charts represented "check pens," so he explained—a check pen of yearling hens and a check pen of pullets. On these two check pens no artificial light was used.

Next he directed attention to four charts that represented four pens of hens, and later he described the other four charts, which represented the egg production of four pens of pullets.

In the case of the eight pens, lights were used during the egg-production season of 1917-1919, starting October 1st and continuing twelve months. Some pens were given twelve hours of light during the short-day period, made up of daylight and a limited amount of artificial light; others had fifteen hours of light in the short-day period, made up of daylight and a considerable amount of electric light, while still others had only nine hours of light in the short-day period and fifteen hours of night.

In every case, both as regards hens and pullets, the birds "under lights," meaning those helped out by artificial light, laid better during October, November, December, January and February than did the "no light" check pens, and the lighted pens in every case also laid more eggs during the following August and September —at the end of the test year, which is another period when new-laid eggs are scarce and therefore bring considerably higher prices than during the flush egg season, represented by March, April, May and June of each year. Said Prof. Rice, in substance:

May Hatched Leghorns

"If our birds are hatched too early in the spring they will begin to lay in the fall and often go into a late-fall or early-winter molt. This means that they will stop laying in the period of high prices, which is not what is desired. May-hatched chicks appear to do best in this section of New York State—in this latitude and climate—'under lights,' as demonstrated by our experiments to date. On the other hand, if pullets are hatched too late, the fall and winter months will find them not matured—with not enough surplus fat stored up in their bodies—therefore they will hold off laying till the period of high prices goes by.

"The remarkable results obtained by the use of 'lights' means, therefore, that we need to revise some of our plans and theories, because here is a successful 'accelerator,' so to speak, by the use of which we can accomplish surprising results not only in the way of increased egg production, but in bringing along to maturity late-hatched birds, though not those that are hatched too late. Our birds, if they are to be placed 'under lights,' must have time to reach the age of production in good form and vigor, doing this before the season of high prices for new-laid eggs is at hand.

"In all our work along this line, let us not overlook the fact that the natural functioning conditions of the domestic fowl are equatorial, so to speak—are based substantially on at least twelve hours of daylight for every twelve hours of darkness and rest. Judging by reports to date, it appears that when we depart very far from this twelve-hour workday during the fall and winter months in northern latitudes, we interfere with heavy production or the health of the birds, or with both. But to date we have these gains to consider: first, a remarkable increase in egg production during the short-day period of the year in northern latitudes; second, the remarkable growth we can secure by the use of lights in the case of immature pullets which, if not given the benefit of 'lights,' would not lay for us in the late fall and early winter but would go through the winter idle and be a heavy charge in the feeding bills. This has been proved conclusively here at Cornell, also by practical, successful poultrymen throughout New York State.

"The actual results shown on these charts prove that the use of artificial lighting within reasonable limits and on an economical basis, pays at both ends of the laying year—during the two seasons when new-laid eggs bring the most money. In other words, we are able by this means to play both ends against the middle, to use a homely but graphic expression. It is a case of robbing Peter to pay Paul, but we have robbed Peter of low-priced eggs during the flush season of the year, March to June inclusive, and have paid Paul in high-priced eggs —eggs laid in excess amounts by our pullets and hens 'under lights,' from October 1st to March 1st and from August 1st following, to the end of September. These charts show that the birds 'under lights' laid somewhat fewer eggs during March, April, May and June than did their competitors 'under lights,' but the difference in the number of eggs laid by the birds 'under lights' brought a good deal more money, on account of the higher prices at the time they responded so well to 'lights.'

Right Length of Lighted Workday

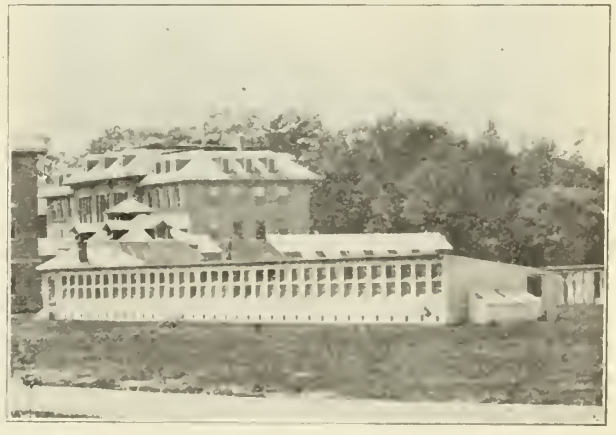
"By the use of artificial illumination we avoid the mass production during the spring months—the period of low prices, and are able to spread production over the year, especially in the fall and winter months, or at both ends of what we may call the laying year. By March 1st the birds not under lights have a chance to catch up with those under lights. On March 21st we have an equatorial day, so to speak, in this latitude, meaning twelve hours of daylight and twelve hours of darkness. On the other hand, December 21st represents our shortest day of the year, and our domestic fowl have been producing eggs accordingly, as regards the amount of daylight, with surprising fidelity. When the nights and days are equal, with the odds in favor of excess daylight—meaning more than twelve hours—these birds are functioning to best advantage—are traveling on an easy grade or level, and with the ease that an automobile does."

Question from audience: "By turning on the 'lights' can we send them up hill 'on high'?"

Prof. Rice continuing: "Yes, and I am glad you asked that question. By use of artificial illumination IN EXCESS we can also force the hens to climb the hill 'on high,' but this no doubt will be to her detriment. We already have learned that illumination in this field must be used with intelligence. We can overlight our fowls, just as we can overfeed them. This, for example, is where the two eggs a day comes in. It is possible to force hens in such manner that special individuals will lay an egg the first thing or early in the morning and again shortly before they are forced to bed by 'lights out.' But in every case of this kind I have heard of the birds, under such treatment, have broken down.

"In a few instances owners of fowls who have tried artificial lighting were so well pleased with the profitable results from the reasonable use of this method, that they decided that if a little of it was a good thing, more of it would be better. In two or three cases they have gone so far as to try eighteen hours of light, including daylight, leaving only six hours of darkness for rest and recuperation. In every such case that I have heard about the results have been decidedly disastrous. Thus far, a twelve to fourteen-hour workday appears to be safe and profitable—the most profitable, I will put it.

"And let me say at this point that we believe lights, when used with judgment, not only will distribute eggs across the year to our financial advantage, but that the use of these lights is also plainly to the physical advantage of the layers. The lighting seems to give them what they want—what is natural for them—that is, an equatorial day or approximately so, with twelve to fourteen hours for feeding, digestion, assimilation, body maintenance and egg manufacture. Where lights are used with



WHERE MANY CORNELL LIGHTING TESTS WERE MADE

Above illustration shows some of the permanent buildings of Cornell Poultry Department where many of Professor Rice's experiments with lighting were conducted. A corner of the Administration Building is shown on the left.

reason the birds seem to be in better health than without lights and these charts and tables show you to what better advantage they lay, as tested by the pre-war market value of their eggs at the time they produced them." (See two tables herewith, one showing a comparison on the basis of pre-war prices; the other a comparison of market prices f. o. b. Ithaca, N. Y., at the time, week for week, that these eggs actually were produced.—Ed.)

Rule That Works Both Ways

Next, Prof. Rice displayed two lighting charts of even greater interest. One showed the effects of "cutting off the lights suddenly." In this case the birds were given artificial lights on the twelve-hour basis for a number of weeks, then without warning the lights were taken away, throwing the birds back on an eight or nine-hour workday, the rest of the twenty-four hours being spent by them on the roosts because of darkness. Going a step farther, after these same fowls had thus been treated to a sudden test of the short, natural day in midwinter, they were again "given the lights" and the other of these two charts showed the result of this experiment.

"Here, indeed, is a remarkable showing. Back in school when we were studying arithmetic, the teacher used to insist that we must prove each problem. That is what we have aimed to do in these two experiments. It is a poor rule that will not work both ways. If the use of lights brought on this remarkable increase in egg production, all other factors being identical or practically so, then the taking away of the lights should have a contrary effect—and surely it did! By Chart No. I of these two you will note that when the lights were shut off, the egg production of this pen, which was so remarkably high for that season of the year, quickly dropped off to practically nothing—did this within three or four days.

HEN WITH RECORD OF 1231 EGGS

The question has been asked: How many eggs can a well-bred domestic hen lay in a lifetime? No one has yet found out. Each time a new world-record is established some other hen comes along and excels it. The 1231-egg hen illustrated above is No. 3477 Cornell University.

"Next we gave these same birds the lights again, doing so after a period of about two weeks and you will note that they began promptly to respond again. Notice here by Chart No. II that they did not get all the way back, as regards high percentage of production, but that they did wonderfully well—did far better than the check pens that were not under lights. This sudden shutting off of the lights undoubtedly meant a tremendous physical shock. These birds had adapted themselves to conditions that were nearer right for them. Then suddenly we changed those conditions. Nevertheless, when again given the lights they responded nobly; therefore it may be said that we tried 'both ways' and in each case obtained the same logical results.*

*Note—The two charts here referred to are combined into one in Color Plate IX, page 15.—Ed.

"My friends, this use of artificial illumination surely comes the nearest to giving us ACTUAL CONTROL OF EGG PRODUCTION of anything we have found to date. We just press a button, turn on the lights and they respond immediately, or practically so. Many tests in widely separated sections of the country and throughout New York State show that largely increased egg yield may be looked for WITH CERTAINTY in about ten days to two weeks after the lights are turned on; that if the birds are of the average quality and in fair condition to lay, as to maturity, health, vigor, etc., you can look for at least double the production you otherwise would obtain during this high-price period for fresh-laid eggs."

Believes Temperature Also Is Important

Question from the audience: "What value do you attach to the matter of temperature?"

Prof. Rice: "I believe that temperature is a very important factor. That is another matter we shall need to test in connection with this new, this revolutionary, development in egg production and seasonal distribution. However, when a hen has plenty of exercise she will, of her own efforts, keep comfortably warm and in a condition to produce well. Exercise is a remarkable source of body heat in all animals. Try it yourself by hustling around in a cold room. Soon you will think you are too warm, where previously you may have been complaining of the cold. But in this matter of temperature, where maximum egg yield is sought, we again must imitate spring conditions by inducing exercise or by employing some other means. The best results in practice from a combination of lights and moderate temperature, is another problem now asking for solution."

Next, Prof. Rice displayed charts showing the daily egg production of three lots of pullets, "throughout the year" which demonstrated the fact that by having the benefit of "lights" these birds were able to reach the limit of egg production two, three and four months AHEAD of the normal time of year for the vicinity of Ithaca, N. Y., thus producing a much larger percentage of eggs in the high-price period. Said Prof. Rice, on this point:

"By a merely casual study of this chart one observes that the effect of the lights was to enable these average-quality pullets to lift a large part of their production from the low-price period of the three spring months over to the high-price or higher-price period of the preceding fall and winter, and they did it without a bit of injury to themselves.

"Furthermore, this chart shows clearly by the color scheme that by turning on the lights you enable your birds to function naturally in that short-day period of the year, so that the individual birds which have the inherent capacity and power to lay 200 eggs in their first year of production will have the chance equally to be 200-eggers! In other words, by this discovery the poultryman is now 'coming into his own' by giving his hens the chance to do what they want to do—to do what they can do and will cheerfully do, if given the opportunity."

Extra Cost of Feed and Lights

Question from the audience: "How about the extra cost of feed?"

Prof. Rice: "Our own experiments, also the reports we have received from practical poultrymen throughout New York State, make it perfectly clear that where lights are used the increased cost of feed is but a small item. By this statement I mean that, when taken across the year, or during the whole period of profitable egg production, whether it be twelve months or ten months or less, the increase in the cost of feed scarcely exists at all. We know, as the result of other research work, that the great bulk of feed at that time of the year, fully eighty-five per cent, goes to body maintenance; therefore the small amount needed as surplus for egg production is not an important or costly item. But the main point to be considered is this: that the hens 'under lights' eat somewhat larger quantities of feed during the period of high-priced eggs, while they are producing eggs liberally, whereas their competitors not 'under lights' will eat an excess amount of feed, in limited degree, during the low-price period, at which time THEY are producing liberally. This means that the advantage, even in regard to cost of feed, is decidedly with the birds 'under lights,' when we look at the matter from the financial side, embracing the entire season of profitable egg production.

"Also we have the question of the cost of lights. Fact is, you can hardly figure this small additional cost, either when you use the individual hen as a unit on a monthly basis, or a dozen eggs. In order to have something to figure on satisfactorily in finding this cost, you need to use a pen of fowls with twenty-five to one hundred inmates, and then you may just as well cover a five or six-month period or the entire season. By reference to this chart and table (displaying new chart) you will see that it cost Cornell University $1.98 to furnish electric lights 791 hours. This cost would provide light for twenty-five to fifty hens from November 28th to the following May 15th, giving them a workday of fifteen hours, from 6 a. m. to 9 p. m. each day. Also note here (again referring to chart) that it cost $1.51 to furnish 602 hours of electric light; that it cost 65 cents to furnish 259 hours of electric light, and that it cost 47 cents to furnish 189 hours of electric light. In each case fifty birds could have been accommodated in each pen, for the period stated—from November 28th to May 15th following, giving them ten to fifteen hours of light (daylight included), or practically that amount."

Question from audience: "What about forced molting?"

Prof. Rice: "As before stated, too much light will overdo it and cause a breakdown. We have had two or three reports to that effect. Also the use of too much light will bring on an early molt, to the detriment of egg production. In all cases the hens or pullets must be in a right condition to start to lay, then if the lights are used with judgment, on the equatorial plan or basis—meaning not to exceed fourteen hours of work to ten hours of rest—they will respond in ten to fifteen days and the average run of birds, as to quality, will 'stand up under the work' and continue to lay well throughout the year. Not only will they do this during the period of high prices at both ends of the year, as before explained, but these same pullets and hens, as is being demonstrated by this year's experiments at Cornell and elsewhere, will lay almost as well during the flush season as their mates that did not have the benefit of artificial illumination.

"In other words, our experiments thus far seem to indicate clearly that the birds 'under lights' are really healthier, suffer less mortality and function better across the year than do those that have to go through a period of privation during the time of long and cold winter nights, lasting four or five months. By giving them the lights it appears that we partially restore natural conditions in a way and to an extent that is truly a benefit to them in all respects, unless we overdo it."

At this point Prof. Rice exhibited a chart entitled, "Influence of Artificial Light on Production and Profits," which is reproduced herewith in tabulated form—see Table No. 1. This table shows fifty pullets and fifty hens, all S. C. White Leghorns. The test was for a period of forty-eight weeks in twelve four-week periods, beginning November 28, 1917-December 25, 1917, and continuing until October 29th inclusive, 1918. One-half the number of pullets were illuminated, also one-half the number of hens, while the remaining fifty per cent of pullets and hens were not illuminated. In this experiment no artificial light was given in the morning; the lights were turned on in the late afternoon, just before twilight and were kept on until 9 p. m.

WHITE WYANDOTTE—RECORD 309 EGGS

Photo from Storrs Experiment Station.

By reference to the two tables (Tables 1 and 2) it will be noted that the birds "under lights," in the first four-week period from November 28th to December 25th gave an egg production of 21.4 per cent, as compared with 12 per cent from the birds not "under lights"; that the birds "under lights" gave a production of 42.2 from December 26th to January 22nd inclusive, as compared with 14 per cent from the nonlighted birds; that from January 23rd to February 19th the birds "under lights" gave a yield of 44.2 per cent, as compared with 25.2 from the same number and quality of birds not under lights but fed and cared for the same way, etc., etc.

Next, it will be noted that in this test the birds NOT under lights laid somewhat more eggs, as expressed in percentage and dozens, from March 20th to August 7th, but that after August 7th—from that date until October 29th, the birds UNDER LIGHTS did decidedly better than those not under lights. To be exact, the birds under lights gave a 20.4 per cent production September 4th-October 1st inclusive, as compared with a yield of 10.1 per cent from the birds not under lights, and the lighted birds, October 2nd to October 29th inclusive, yielded 19.3 per cent pro-

INFLUENCE OF ARTIFICIAL LIGHT ON PRODUCTION AND PROFITS

100 (50 Pullets, 50 Hens) S. C. White Leghorns at Cornell University, Ithaca, N. Y., for Forty-eight Weeks in Twelve Four-week Periods—Nov. 28, 1917, to Oct. 29, 1918

Key: Ill.—Illumination.
Pct.—Percentage.
N. A .L.—No Artificial Light.
Artificial Light, Twilight to 9 P. M.

Twelve 4 Week Periods	Nov. 28 Dec. 25	Dec. 26 Jan. 22	Jan. 23 Feb. 19	Feb. 20 Mar. 19	Mar. 20 Apr. 16	Apr. 16 May 14	May 14 June 11	June 12 July 9	July 10 Aug. 6	Aug. 7 Sept. 3	Sept. 4 Oct. 1	Oct. 2. Oct. 29
Pct. Egg Yield, Ill.	21.4	42.2	44.2	47.2	51.5	40.0	39.5	35.2	36.0	28.2	20.4	19.3
Pct. Egg Yield, N.A.L.	12.0	14.0	25.2	40.5	57.8	56.0	45.4	40.2	36.1	24.3	10.1	5.5
Gain or loss in Pct. Ill.	*9.4	*28.2	*19.0	*6.7	—6.3	—16.0	—5.9	—5.0	—.1	*3.9	*10.3	*13.8
Gain or loss in doz., Ill.	*21.9	*65.8	*44.3	*15.6	—14.7	—37.3	—13.7	—11.6	—.23	*9.1	*24.0	*32.2
Pre-War Price per dozen	51c	45e	34c	30e	25e	23c	25c	28e	30c	35c	40c	53e
Gain or Loss in Value, Ill.	*$11.17	*$29.61	*$15.60	*$4 68	—$3.68	—$8.58	—$3.43	—$3.25	—$.07	*$3.19	*$9.60	*$17.06

*Gain.
—Loss.

Total gains in dozens	212.90	Total gains in value	$90.91
Total losses in dozens	77.53	Total loss in value	19.03
Differenee	135.37	Difference	$71.88

TABLE No. 1—Showing benefits of the use of "lights" on 50 pullets and 50 hens given artificial illumination from daylight until 9 p. m. during a period of forty-eight conseeutive weeks—practieally a year—as compared with an equal number of pullets and hens (both lots S. C. White Leghorns, Cornell strain) that were of the same flock and quality and that received the same care and feed, but were not "under lights". This table (No. 1) is based on the pre-war prices, f.o.b. Ithaca, N. Y., obtainable for eggs in each four weeks' period. Note that the "lighted" birds laid best from November 28 to Mareh 19 inelusive, also from August 7 to October 29 inclusive, whieh is the high-priee period, while in this test the nonlighted birds laid the most eggs March 20 to August 6 inelusive. For the entire period the 100 birds "under lights" laid 135.37 dozen more eggs than did their nonlighted competitors, whieh eggs converted into eash showed a net gain in favor of the lighted birds of $71.88, or practically 82 eents per bird, all of which was profit, in ease the nonlighted birds "earned their keep" by their production.

duction, as compared with only 5.5 per cent from the check pen not under lights.

In making up this table (Table No. 1 herewith) Prof. Rice used the "pre-war prices per dozen, thus to make the figures seem more reasonable,"as he expressed it. Yet on this basis the hens under lights earned an excess profit of $71.88, as compared with their competitors not under lights, doing this by laying 135.37 dozen MORE EGGS in the forty-eight weeks than did an equal number of birds of the same quality not under lights, and they laid these excess eggs DURING the high-price periods.

The attentive and earnest reader will be interested to know that the ACTUAL market prices for new-laid, white-shelled eggs f. o. b. Ithaca for this period, November 28, 1917, to October 29, 1918, were as follows:

November 28-December 25	69 cents
December 26-January 22	71 cents
January 23-February 19	59 cents
February 20-March 19	43 cents
March 20-April 16	38 cents
April 17-May 14	39 cents
May 15-June 11	43 cents
June 12-July 9	48 cents
July 10-August 6	55 cents
August 7-September 3	61 cents
September 4-October 1	66 cents
October 2-October 29	82 cents

By "f. o. b. Ithaca," is meant that the New York prices (so Prof. Rice informed us) were 2 cents per dozen higher than the above throughout the year here covered. This two cents represents the commission on eggs sent from Ithaca to the New York market, plus express charges and the return charge on the empty egg cases.

In view of the fact that these identical eggs were produced by the use of feeds paid for at war-time prices, we have made up a companion table to the one prepared by Prof. Rice (Table No. 2 herewith), using the actual f. o. b. Ithaca prices for the twelve months, thus to give both lots of pullets and hens (the lighted and not-lighted) full credit for what they actually did, doing this in the shape of financial returns. We asked Prof. Rice if to do this would not be fair, as a matter of fact, and he replied that it would, but that the astonishing difference in returns on that basis might cause the average person to expect too much. However, with the explanation here given, we feel there can be no real danger along that line. Attention, therefore, is directed to Table No. 2 herewith, for examination in connection with Table No. 1, both being entitled "Influence of Artificial Light on Production and Profits."

But to get back to our report of the School. At this time Prof. Rice looked at his watch, found that he had used up the time allotted to him on the program and remarked, with a smile:

"Must confess that I have NOT YET reached my subject, 'The Influence of Illumination on the Characters Indicating the Laying Capacity of Fowls'; (Applause) therefore I must take my chance on getting in later with that somewhere else, on the full program we have. Please accept my apology. As you can readily judge, I am deeply interested in this subject—and I notice that you are! One could not ask better attention than I have received and the same has been true of every other speaker thus far. No one can doubt the earnestness or interest of this convention and I believe this spirit of keen interest will continue throughout the week."

INFLUENCE OF ARTIFICIAL LIGHT ON PRODUCTION AND PROFITS

100 (50 Pullets, 50 Hens) S. C. White Leghorns at Cornell University, Ithaca, N. Y., for Forty-eight Weeks in Twelve Four-week Periods—Nov. 28, 1917 to Oct. 29, 1918.

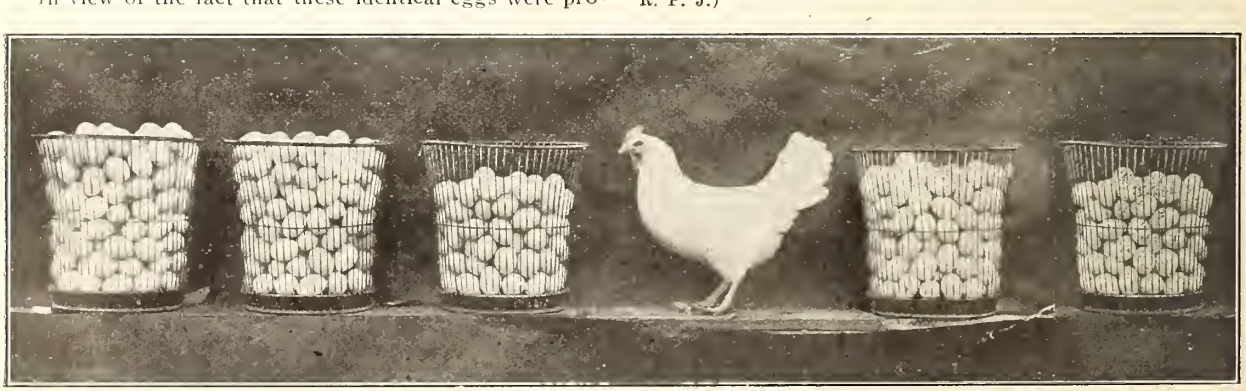
Key: Ill.—Illumination.
Pct.—Percentage.
N. A. L.—No Artificial Light.
Artificial Light, Twilight to 9 P. M.

Twelve 4-Week Periods	Nov. 28 Dec. 25	Dec. 26 Jan. 22	Jan. 23 Feb. 19	Feb. 20 Mar. 19	Mar. 20 Apr. 16	Apr. 16 May 14	May 14 June 11	June 12 July 9	July 10 Aug. 6	Aug. 7 Sept. 3	Sept. 4 Oct. 1	Oct. 2 Oct. 29
Pct. Egg Yield, Ill.	21.4	42.2	44.2	47.2	51.5	40.0	39.5	35.2	36.0	28.2	20.4	19.8
Pct. Egg Yield N. A. L.	12.0	14.0	25.2	40.5	57.8	56.0	45.4	40.2	36.1	24.3	10.1	5.5
Gain or loss in Pct. Ill.	*9.4	*28.2	*19.0	*6.7	—6.3	—16.0	—5.9	—5.0	—.1	*3.9	*10.3	*13.8
Gain or loss in doz., Ill.	*21.9	*65.8	*44.3	*15.6	—14.7	—37.3	—13.7	—11.6	.23	*9.1	*24.0	*32.2
Pre-War Price per Dozen	59c	71c	59c	43c	38c	39c	43c	48c	55c	61c	66c	82c
Gain or Loss in Value, Ill.	*$15.11	*$46.72	*$26.14	*$6.71	—$5.50	—$14.55	—$5.89	—$5.57	—$.13	*$5.55	*$15.84	*$26.40

*Gain.
—Loss.

Total gains in dozens	212.90	Total gains in value	$142.47
Total losses in dozens	77.53	Total loss in value	31.78
Difference	135.37	Difference	$110.74

TABLE No. 2—Which is the same as Table No. 1 herewith, except that in this table the eggs produced by both the lighted and nonlighted birds are treated as being sold at current prices obtainable at Ithaca, N. Y., during the 48 weeks that these eggs were produced, said Ithaca, N. Y., prices being 2 cents per dozen for each period under the New York City prices, this difference being deducted to take care of the commiasion merchants' charge, also the expressage on the eggs and the return cost for getting the egg cases back to Ithaca. This ia the basis on which the Poultry Department of Cornell University estimates the value of eggs produced on the College plant. New-laid eggs treated in this way are equivalent to cash. The current cost of grain and other poultry feeds during this 48-week period was charged at the actual prices paid for same, meaning war prices, therefore, it is fair to give these fowls, both the lighted and the nonlighted pens, credit on the same basis for the eggs they laid—that is, the prices that actually were obtainable for them during the twelve four-week periods, when these eggs were produced. See article herewith for further information about this test. Note that on this basis the "lighted" birds earned $1.10 each more per head than did the nonlighted fowls.



WHAT THESE LITTLE THREE TO FOUR-POUND "EGG FACTORIES" CAN DO ACROSS THE YEARS

Illustration above is of "Queen Utana", a remarkable five-year egg producer who, during her first laying year, produced 195 eggs; second year, 193; third year, 138; fourth year, 161; and fifth year, 129 eggs, making a total of 816 egga in five laying years. Waa bred and owned by the Utah Agricultural College, Logan, Utah. Eggs in baskets represent this little hen's actual production during the five years. No "lights" were used in this case.

(Note: This article is reprinted from the October 1919 issue of R. P. J.)

Influence of "Illumination" on Egg Production "Characters"

IN THIS CASE EGGS FROM "LIGHTED" PENS HATCHED BETTER—RECORDS ARE HERE GIVEN OF TESTS MADE AT CORNELL UNIVERSITY FROM NOV. 4, 1918, TO JUNE 15, 1919—"LIGHTS ON" FROM 3:00 A. M. TILL DAWN PRODUCED WONDERFUL RESULTS IN THE CASE OF BOTH HENS AND PULLETS--TRIED A "MIDNIGHT LUNCH" WITH GOOD RESULTS—VALUABLE EFFECT OF LIGHTING ON LATE-MOLTING HENS—"LIGHTING" IS AN "ACCELERATOR," BUT DOES NOT COUNTERACT CHARACTERS WHICH INDICATE THE LAYING CAPACITY OF FOWLS

By JAS. E. RICE, Professor of Poultry Husbandry, New York State College of Agriculture, Cornell University, Ithaca, N. Y.

THE subject of this address by Prof. Rice was, "The Influence of Illumination on the Characters Indicating the Laying Capacity of Fowls." As stated on page 78 of this book, Prof. Rice delivered two addresses on the lighting problem before the Judging School, July 7-12, 1919, one of a general nature on the subject of the use of artificial light to increase egg production, the other being reported herewith.

To illustrate the present subject, Prof. Rice presented a table showing the results to June 15, 1919, of the latest illumination tests at Cornell, which were started November 4, 1918 (table, in two parts, is reproduced herewith), and also showed several charts in colors (not previously exhibited) which indicated clearly that by placing the birds under illumination we simply "set the clock ahead," so to speak, in the sense that their growth is accelerated, if they have been backward in that respect, while if they are ready to lay the "lights" start them at it without loss of time, almost regardless of weather conditions, and thereafter their production or nonproduction, as regards eggs, can be determined by external characters and physical examination, EXACTLY as though the owner or observer were to wait two, three or four months later until spring conditions exist and the longer sunlight days have acted in the usual way for a northern climate, in bringing on egg production.

In other words, AS SOON as these birds "under lights" BEGIN TO LAY, the yellow pigment starts to disappear and follows the same course it would "without lights" two or three months later, or during the early spring—disappearing first around the vent, then from the eye ring, next from the base of the beak, etc. Also if egg production ceases with any individual hen, no matter for what reason, the yellow pigmentation returns, first around the vent, then in the eye ring, next at the base of the beak, etc. The other external characters respond proportionately under lights, and without unusual delay. Actual egg production is the governing factor. The vent will become moist, the skin more pliable, the pelvic bones spread apart, the comb becomes full and warmer to the touch, etc. Likewise this "speeding up" of egg production, as a result of longer workdays in the late fall and winter, will bring on the molt somewhat earlier, as a rule. After the different hens have "laid themselves out," so to speak, according to their individual power or capacity, they cease laying and this generally brings on molting, either partially or a full molt.

Colored charts exhibited by Prof. Rice showed a decided correlation of these several points, including actual egg production, with earlier changes of external characters, earlier molting of the individual birds, etc. He also spoke at some length about the "Fertility and Hatchability of Eggs Produced Under Lights," in connection with these 1919 tests and exhibited tables that showed some surprising records. Referring to this particular phase of the subject, he said, in substance:

"Perhaps I ought not give out this information at present, for fear it may prove misleading. It takes more than one swallow to make a summer and we do not as yet have the data to justify us in drawing conclusions in regard to this very important matter, let alone proclaiming any positive or definite correlation. On the other hand, this information is of such vital interest that I felt you should have it, with these WORDS OF CAUTION as to the very limited amount of data on which it is based. If this one test proves to be the rule, rather than an exception, we have here something of great value; of that we may be sure. Perhaps it is true and dependable, but we cannot be sure of that until we have ample confirmation."

The foregoing timely and earnest remarks by Prof. Rice were meant to apply particularly to a special table of figures he exhibited, showing the influence of artificial illumination on the fertility and hatchability (especially the latter) of eggs laid by certain S. C. White Leghorns kept under lights in tests started November 4, 1918, and continued to June 15, 1919, and thereafter.

Eggs From "Lighted" Pens Hatched Better

Briefly stated, eggs were incubated from ten test pens "under lights" and these results developed: The eggs from the check pen of hens not under lights produced 51 per cent in live, strong chicks, while the pen that had lights from 3 a. m. each day during the period until dawn, gave 56 per cent in good, lively chicks. In the case of pullets, the check pen not under lights produced 56 per cent in good chicks, while the pen of pullets that were given the lights from 3 a. m. until dawn each day during the period produced 75 per cent in satisfactory chicks. The other pens "under lights" for different hours (morning or evening, one or both) and in different amounts, did quite well in hatchability, but not equal to the pen of hens and the pens of pullets that had the lights from 3 a. m. until dawn. It appears that in this particular case (see results given further along in this report) the birds, both hens and pullets, that were under the lights from 3 a. m. until dawn, not only laid the most eggs, throughout the test period, but also laid eggs that were highest in hatchability—that gave the greatest percentage of good, strong chicks.

The foregoing advance information is given somewhat out of order in this report, so as to dispose of it and get to the main facts of the subject, as handled by Prof Rice. After warning his hearers not to be misled, or to base hasty conclusions on one experiment, he exhibited the table herewith reproduced entitled "Total Egg Production of Hens in Illumination Test, From November 4, 1918, to June 15, 1919," as conducted at Cornell University, Ithaca, N. Y. The remarks of special caution, as made by Prof. Rice, apply only to the percentages given by him on comparative "Fertility and Hatchability" and not to the actual EGG YIELD secured to June 15, with and without lights.

The special attention of R. P. J. readers is directed to this table. The results there shown are REMARKABLE INDEED. Eleven pens are shown, five of hens

and six of pullets. All pens at the start each contained twenty-five birds and Prof. Rice told us that they were "reject birds"—as a matter of fact, were hens and pullets that ordinarily they sell on the market for table use. They were birds that were left on hand after they had picked out everything they wanted for other experiments, including a surplus for replacements. Other years these "left-overs" would have been sold on the local market, but last fall they were kept to be placed "under lights," in order to learn what the effects would be.

Readers who are especially interested in the use of artificial illumination to increase fall and winter egg production will note by reference to these tables that there was a check pen of hens and a check pen of pullets.

Pen No.	HENS	Amt. of Illumination	Mort. to June 1	Eggs to Dec. 25	Eggs to Jan. 20	Eggs to Feb. 23	Eggs to April 20	Eggs to June 15
21	Hens	Check Pen No Illumination	0	55	111	260	908	1576
13	Hens	5 A. M. to 7 P.M.	2	170	274	473	807	1232
23	Hens	3 A. M. to Dawn	1	305	503	763	1189	1675
26	Hens	9 P. M.	2	200	244	360	604	977
19	Hens	3 A. M. to 9 P. M.	0	205	282	467	782	1068
		July Molt						
15	Hens	9 P. M.	2	325	427	521	709	850
		August Molt						
16	Hens	9 P. M.	2	441	578	784	1132	1536
		October Molt						
17	Hens	9 P. M.	2	300	470	639	1033	1406

Total Egg Production of Hens in Illumination Test From November 4, 1918, to June 15, 1919

This table relating to HENS, and the accompanying one, relating to PULLETS, were furnished by the Poultry Department of the New York State College of Agriculture, Cornell University, Ithaca, N. Y. They show late results (down to June 15, 1919) of the remarkable benefits of the use of artificial light to increase egg production during the short-day season of the year, in this case from November 4, 1918, to June 15, 1919. Pen No. 21 is the "check pen", no artificial light being used with this pen. Compare the low production of that pen with the high production of pens 13, 23 and 26. It will be observed that the best results were obtained where the hens were given "lights" from 3 a. m. till dawn, without any artificial light being used at night or during the evenings. Also note in particular pens 15, 16 and 17. Hens recently molted were in these pens and "lights" were given them in the evening, up to 9 p. m. in each case. In all three cases their production was much in excess of the nonlighted check pen, Pen No. 21.

These two pens did not have the benefit of any artificial light. The other nine pens, however, had lights in varying amounts. Pen No. 13 of hens, for example, and Pen No. 12 of pullets, had the lights turned on at 5 a. m. and again in the afternoon until 7 p. m., whereas Pen No. 23 of hens and Pen No. 22 of pullets had the light turned on at 3 a. m., with no help of this kind in the afternoon or evening. Notice the astonishing results, especially in the case of both hens and pullets where the lights were turned on at 3 a. m. and kept on until dawn. Compare the egg production of these lighted birds, both the hens and pullets, for EACH PERIOD of time for laying with the "check pen" of hens and pullets respectively. To emphasize this important, timely and truly astonishing information we make the comparison here, as follows:

HENS—Hens in check pen, November 4 to December 25—laid 55 eggs. Same number of hens, under lights 3 a. m. to dawn, same period—laid 305 eggs.

Hens in check pen, December 26 to January 20, inclusive—laid 111 eggs. Same number of hens, under light, same period—laid 503 eggs.

Hens in check pen, January 21 to February 23 inclusive—laid 260 eggs. Same number of hens, under lights, same period—laid 763 eggs.

Hens in check pen, February 24 to April 20 inclusive—laid 908 eggs. Same number of hens, under lights, same period—laid 1189 eggs.

PULLETS—Pullets in check pen, November 24 to December 25—laid 151 eggs. Same number of pullets, under lights, 3 a. m. to dawn, same period—laid 450 eggs.

Pullets in check pen, December 26 to January 20 inclusive—laid 263 eggs. Same number of pullets under light, same period—laid 769 eggs.

Pullets in check pen, January 21 to February 23 inclusive—laid 485 eggs. Same number of pullets under light, same period—laid 1112 eggs.

Pullets in check pen February 24 to April 20 inclusive—laid 1163 eggs. Same number of pullets under lights, same period—laid 1622 eggs.

If we may judge safely by this experiment, it would appear that putting the lights on at 3 a. m. each morning, September first to the following March first, each season, should give the best results. However, in this matter also Prof. Rice advised caution. Said he, in substance:

"A Remarkable, A Revolutionary Discovery"

"Here we have a remarkable, a revolutionary discovery or advancement in poultry culture. If it is as good as it seems, and I believe that it is, we can afford to proceed carefully, within reason. Such results as these hens and pullets have given us under lights—especially where the lights were turned on at 3 a. m., are absolutely astonishing. They seem 'too good to be true,' and yet this table is accurate, these results are ACTUAL, and I think you will agree with me in the use of the word 'revolutionary' in describing such remarkable production. What the results might have been if these fowls had been truly high producers, consisting of birds bred-in-line for prolific egg yield, I am not prepared to say. Naturally we ought not expect more than one egg a day per hen, hence the financial benefit to the average poultryman in the use of lights will be greater per bird from average layers and moderately good layers than from the really high-production individuals. Yet no doubt by 'lighting' our birds during the short-day period of each season we can get the maximum supply of eggs two, three or four months earlier, as compared with past achievement and these excess eggs in the fall and early winter will bring us twice the amount in cash, which to date has been about the general rule, where lights have been used with average judgment. But as I said before, let us be careful not to draw wrong conclusions in this matter of the use of illumination. It is not yet time for final conclusions.

Pen No.	Pullets	Check Pen	Mort. to June 1	Eggs to Dec. 25	Eggs to Jan. 20	Eggs to Feb. 23	Eggs to April 20	Eggs to June 15
20	Pullets	No Illumination	0	151	263	485	1163	1652
12	Pullets	5 A. M. to 7 P. M.	3	401	540	774	1258	1616
22	Pullets	3 A. M. to Dawn	0	450	769	1112	1622	2127
24	Pullets	9 P. M.	3	420	619	901	1437	1911
18	Pullets	3 A. M. to 9 P. M.	0	353	484	795	1257	1756
		Night Feed						
14	Pullets	8:30 P.M. to 9 P.M.	1	236	372	724	1417	1845

Total Egg Production of Pullets in Illumination Test From November 4, 1918, to June 15, 1919

This table, relating to PULLETS, and the accompanying one, relating to HENS, were furnished by the Poultry Department of New York State College of Agriculture, Cornell University, Ithaca, N. Y. They show late results (down to June 15, 1919) of the remarkable benefits of the use of artificial light to increase egg production during the short-day season of the year, in this case from November 4, 1918, to June 15, 1919. Pen No. 20 is the "check pen", no artificial light being used with this pen. Compare the low production of that pen with the high production of Pens 12, 22, 24 and 18, especially with Pen No. 22, where the lights were turned on at 3 a. m. and left on until dawn, no artificial light in this case being used at night or during evenings. Also note particularly Pen No. 14. In this case the pullets were given what was styled a "night feed"—that is, the lights were turned on at 8:30 p. m. and turned off at 9 p. m., giving these birds "thirty minutes at the lunch table", as Prof. Rice expressed it. Compare the production of this pen with "check pen" No. 20, which was not illuminated, either morning or night. The increase is substantial, straight through the period, yet Prof. Rice told the Judging School at Cornell, July 7-12, 1919, that in his opinion the half hour was not enough; that probably these birds would have made a considerably better showing if the lights had been kept on au hour or so.

"The question of a resting period for our high producers—either birds bred-to-lay or those enabled to function earlier or more rapidly under lights—has been brought up here for discussion. It appears that by the use of lights we can give our birds this rest period, at least in large degree, during the season of low prices for eggs. Our records here at Cornell thus far are illuminating in that respect. As I pointed out to you the other day in connection with the first set of colored charts, those tests in 1917-1918 showed that we got largely increased production in the fall and winter months; then the birds under lights let up a little, quite a little in the number of eggs, though they were low-priced eggs. This was during the flush season—March to July inclusive; then they came on again comparatively strong in August, September and October when the nonlighted birds were in the molt or on a strike

and when the market prices of eggs were again rapidly on the upgrade.

"As regards the number of hours that may be the most productive as a workday for our hens, that is a matter still to be determined. The results from birds this past season here at Cornell, both in the case of hens and pullets, with lights turned on at 3 a. m. and not used at all in the afternoon or at night, were truly sensational; but perhaps this is not the best plan after all. There may be some other equally good or better combination. It remains for us to find out by test—by a sufficient number of tests—to make sure, and under varying conditions. Moreover, different classes of poultrymen or poultry keepers have different requirements. We think that the farmer, for example, as the owner of a commercial flock kept for egg production, would prefer a morning and evening combination, or perhaps we might call it 'the farmer's combination.' How convenient it would be for him if we should find by repeated tests that when the short days come he can start his lamps, or snap on the lights, when he starts to do the evening chores and then the next morning can repeat this when he goes out with his lantern to do the morning chores. While these chores are being done and the housewife is getting breakfast he can put the hens to work, doing so with very little extra labor, yet with a decided increase in egg yield and in cash receipts from that source."

Pen No.	Hens	Amt. of Illumination	Mort. to June 1	Eggs to Dec. 25	Eggs to Jan. 20	Eggs to Feb. 23	Eggs to April 20	Eggs to June 15
21	Hens	Check Pen No Illumination	0	55	111	260	908	1576
15	Hens	July Molt 9 P. M.	2	325	427	521	709	850
16	Hens	August Molt 9 P. M.	2	441	578	784	1132	1535
17	Hens	October Molt 9 P. M.	2	300	470	639	1033	1406

Egg Production of July, August and October Molters Under Illumination From November 4, 1918, to June 15, 1919

This table, in part, is a reproduction of the table on page 84, entitled, "Total Egg Production of Hens in Illumination Test From November 4, 1918, to June 15, 1919." Pens Nos. 21, 15, 16 and 17 are here reproduced from that table, for the convenience of our readers. Pen No. 21 is the "check pen" and pens Nos. 15, 16 and 17 are the three in which hens that had been in molt or were in molt were placed. Studying this table the reader will conclude that by November 4th the hens that went into molt during July were pretty well along in the molt, or entirely out of it. With that fact in mind, note the production of this pen as compared with "check pen" No. 21. In the case of hens that molt in August it will be observed that placing lights on them appeared to bring them along rapidly, so that their production actually was greater than that of the birds that molted in July—"early molters" these July birds would be called and inferior as layers, as a rule, on account of poor breeding or failure to inherit egg production capacity and ability. As early as November 4th, when this lighting test was started, the birds in Pen 17, consisting of "late molters" that did not drop their feathers until October, had only been in the molt a short time, yet under the helpful effect of the lights they quickly came back, produced eggs far ahead of the "check pen", and by January had passed the July molters, which lead they maintained with a wide margin—a highly profitable margin—straight through to the end of the test, or to June 15th inclusive.

Question from audience: "Did your last year's experiments confirm the advantage of 3 a. m. lighting, with no artificial illumination at night?"

Prof. Rice: "We did not try that particular application of lights last season, but used other combinations. To date this 3 a. m. lighting, with no artificial help at night has given us the most sensational yield, both from hens and pullets."

Gave One Pen "A Midnight Lunch"

Referring again to the table reproduced herewith, giving the egg yield of the five pens of hens and the six pens of pullets, November 4, 1918, to June 15, 1919, Prof. Rice said, in substance:

"Observe next the effect of what we called a night feed or 'midnight lunch' given one pen of pullets—pen No. 14. Here we tried the experiment of a thirty-minute feeding time each evening for the period from 8:30 to 9 p. m. Compare the results with the check pen of pullets. The increase really is noteworthy, but not equal to the pen of pullets that had lights from 3 a. m. until dawn. Apparently the thirty-minute period at the 'lunch counter' did not give these pullets sufficient time to fill their crops and thus place themselves on a par with other pens that had a longer workday. We are curious to know how this would have panned out if we had given them an hour for an extra feed each evening, in place of the thirty minutes. That is another point to be cleared up. If one hour of extra feeding time each evening or night will give us a maximum yield, or practically so, this may be the right combination of daylight and artificial light to adopt, on a commercial basis."

"Lighting" Test on Hens in Molt

"Next, I direct your attention to another table which shows some of the effects of artificial lights on hens that have molted. In this case (see table herewith, entitled 'Egg Production of July, August and October Molters Under Illumination,' November 4, 1918, to June 15, 1919) we placed the lights on three pens of S. C. White Leghorns, each pen containing twenty-five birds, omitting the lights in the morning but keeping them on until 9 every evening. In one pen were birds that had molted in July; in another, birds that had molted in August and in the third pen were truly late molters—those that did not go into the molt until October.

"Now compare the results here (pointing to the table) and you will note that the July molters were benefited most and that the October molters were the least benefited of the three lots. It is easy to offer an explanation, other things being equal. The July and August molters both had a good period of rest from the time they started to molt until the lights were turned on them November 4th, whereas the October molters had only three, four or five weeks of rest—five weeks at most.

"This would appear to 'throw light' on the question of how long hens should be allowed to rest during the molting period. We believe that we can overdo the amount of illumination, as in the case of the eighteen-hour workday previously referred to, and it would appear also that we can put the lights on hens in molt too soon. This just illustrates another side of the revolutionary character of the use of artificial illumination. It not only will accelerate molting, but it also may start the molting hens back into production before they are ready, in which case we invite a breakdown and disaster.

"Before leaving this table that shows the actual production of the three pens of molters, you no doubt will want to compare their yield with that of the hens which were not under light, as shown on the other table. Even the October molters, with only a short period of rest, gave an egg yield, December 25th to the following March 1st, greatly in excess of the check pen of hens not under lights."

Question from audience: "What kind of lights give best results?"

Prof. Rice: "Judging by reports we have received from users of lights all over the state, electric lights are the most convenient, but gasoline lanterns also are very popular. They give a brilliant light and users of them secure results equal to the best obtained by the use of electricity. On the other hand, electricity obviously is more convenient."

Question from audience: "How about the cost of lighting?"

Prof. Rice: "You can scarcely figure it, it is so small per hen or per dozen eggs. Also the difference in the amount of feed consumed, when figured across the year is practically negligible. By the use of lights we simply transfer the eggs from a low to a high-price period and, as a rule, feed is cheaper in the fall than during the following spring and summer. Across the year, or taking a period of eight, ten or twelve months, the birds under lights will eat no more than those not under lights, other things being equal as to breed, size of birds, etc. We need to bear in mind that 65 per cent of the contents of the egg is water, therefore the actual extra food required is reduced to a small factor.

Convenient Hours for "Lighting"

"Before we turn away from this table that shows total egg production of pens under illumination here at Cornell the past season (November 4, 1918, to June 15, 1919) let us not fail to observe how well the pullets did, as compared with the check pen of pullets which received no artificial light IN THE MORNING, but had the benefit of it in the evening until 9 p. m. This is pen No. 24 of pullets. You will note that for the first period they laid 420 eggs as compared with 151 eggs laid by the

check pen; that for the second period they laid 619 eggs, as compared with 263 eggs laid by the unlighted birds; that for the third period they laid 901 eggs, as compared with 485 laid by the check pen of pullets not under lights.

"Perhaps in many cases this EVENING LIGHTING, from early twilight until early bedtime, will suit the poultryman better, including the back-lotters; but putting on the lights at 3 a. m. has the advantage of not having the worry of shutting them off at any exact time, because the coming of dawn or daylight will merge the artificial day into the natural day. On the other hand not many poultrymen, unless I am much mistaken, will relish the idea of getting out of bed at 3 a. m. to light the lantern or lanterns, though if electricity is available it can be snapped on very easily, or can be turned on by some automatic device. All these experiments are very inviting and each before long will find a satisfactory solution. The real BIG THING is our discovery and demonstration of what a lengthening of the workday WILL DO in the way of increased egg production during the annual season of scarcity and consequent high prices. Here is a great boon to us poultrymen, also to all mankind, especially in northern latitudes. IT APPEARS TO BE ONE OF THE MOST FORTUNATE THINGS THAT HAS HAPPENED TO US THUS FAR IN THE DEVELOPMENT OF THE POULTRY INDUSTRY."

Question from audience: "Did you find that the 'speeding up' under lights, increased mortality?"

Prof. Rice: "On the contrary, the OPPOSITE appears to be true. It seems as though the longer day for feeding, exercising and functioning is of real benefit to these fowls 'under lights'; that they are healthier, more active and freer from ailments and disease. This ought to be so, in order for them to keep up bodily maintenance and lay an extra number of eggs, and our observations are to the effect that it is so."

Question from audience: "These birds under lights slowed up a little, as a rule, did they not, in the spring season?"

Prof. Rice: "That was what happened last year, in 1918, so far as tests here at Cornell showed, but not so this season in the case of both hens and pullets that had the lights from 3 a. m. until dawn, as you will see by this chart. In the case of the pullets, see pen No. 24 here, they also outlaid the check pen all winter and up to June 15, which is as late as this report shows. They may soon fall behind, but they were 'way ahead up to halfway through the first month of summer."

Pigmentation Changes "Kept Pace"

Next, Prof. Rice directed special attention to five charts IN COLORS that were based on the actual egg production of the pens under lights, November 4, 1918 to June 15, 1919, the five pens of hens and six pens of pullets. These charts demonstrated that as actual production went on, not only did pigmentation changes KEEP PACE with it, but that, later on, molting did the same thing. Neck molting would start first, this to be followed by body molting and then the wing flights would drop out in pairs. These charts, as explained by Prof. Rice, seemed to prove beyond question that the use of lights, to the extent of increasing egg production, merely brings on SOONER these natural, external signs and changes that indicate the condition of the bird as to production, also to what extent she has produced, etc.

The speaker's conclusions were to the effect, therefore, that the use of lights is not going to interfere with judging and estimating egg production by external characters and physical examination; that, on the contrary, this newly developed plan of selecting the laying hens and eliminating poor producers and those that have finished for the season, will not be rendered more difficult in practical use by the employment of "lights," nor of any less real value.

At the Cornell Poultry Plant, July 7-12, we saw the eleven pens of S. C. White Leghorns "under lights," each pen containing twenty-two to twenty-five birds (in several cases one, two or three birds had died, in the natural course of things), the size of each pen being 12x14 feet and connecting with a runway 12x25 feet. In the center of each pen, suspended from the ceiling, was a twenty-five-watt Mazda incandescent light which Prof. Rice pronounced to be ample in such pens for lighting purposes. These birds were let out of doors April first and thereafter, as a rule, but were kept confined in the 12x14-foot houses during the winter, from November 4, when the lighting test started, until the following April first. There was a male bird in each pen, so that the eggs could be incubated if desired.

Lighting Report Made by H. E. Botsford, of Poultry Department, New York State College of Agriculture

In outlining to the School the different projects carried on during 1918 and 1919 by the Poultry Department of the New York State College of Agriculture, also projects to be conducted during the season of 1919-1920, one of the field extension workers of the department, H. E. Botsford, reported that men representing the Cornell Poultry Department had visited one or more times, eleven state institutions on which there are poultry plants for the use of these institutions respectively. At one such institution where from 550 to 700 S. C. White Leghorns are kept, mainly for egg production—an institution where good cooperation was found, he recommended the installation of "lights," with the following results:

Egg Yield "Without Lights," January 1, 1918, to June 30, 1918, Inclusive

Month	No. Birds	Eggs Produced	Per cent Production
January	540	2346	15.5
February	540	2520	16.7
March	514	4032	25.3
April	508	5106	32.7
May	485	5422	36.4
June	467	6183	44.1

Egg Yield "With Lights," January 1, 1919, to June 30, 1919, Inclusive

Month	No. Birds	Eggs Produced	Per cent Production
January	687	6083	28.6
February	673	9086	47.8
March	654	10661	52.6
April	650	10464	53.4
May	647	9583	48.0
June	638	8323	43.7

In the above case (also see accompanying graph) it will be noticed that it was not until June—probably the latter half of June, that the birds not under lights caught up with those under lights. Readers who are not familiar with reports of this kind will appreciate being told that in such an experiment as this it is the "percentage of production" that shows the real comparison, whether it be favorable or unfavorable. For example, in the above tabulation the birds not under lights produced in January, 1918, a percentage of fifteen and one-half eggs for the month—that is, at the rate of fifteen and one-half eggs per day from each 100 birds. Referring to the same month the year following, when a larger number of birds were under lights, the caretaker gathered during the month twenty-eight and six-tenths eggs per day for each hundred birds. Next, consider March, for the same kind of comparison. The birds not under lights March, 1918, yielded twenty-five and three-tenths eggs for each hundred birds, whereas the year following, the flock under lights, kept in the same quarters and given substantially the same care, yielded at the rate of sixty-two and six-tenths eggs, for each one hundred birds.

Surely it is no wonder that Prof. Rice, Mr. Bots-

ford and many others are enthusiastic about this matter of using artificial illumination to prolong the functioning day of hens and pullets during the fall and winter, especially in northern climates. Writer has been closely connected with the poultry industry of the United States and Canada during a period of twenty-five years and we never have known of a new method that was as surprising, IN UNIFORM GOOD RESULTS, as this one. In the words of Prof. Rice, it is certain, so it would appear, to work "nothing short of a revolution in the poultry industry of our country."

For the season of 1919-1920 the Poultry Department of the New York State College of Agriculture is going to make a regular field project of the use of artificial illumination to increase egg production and is to send competent men through the state with instructions to urge the use of artificial lights on all layer-flocks of considerable size, both on poultry plants and in the hands of farmers.

Said Prof. Rice:

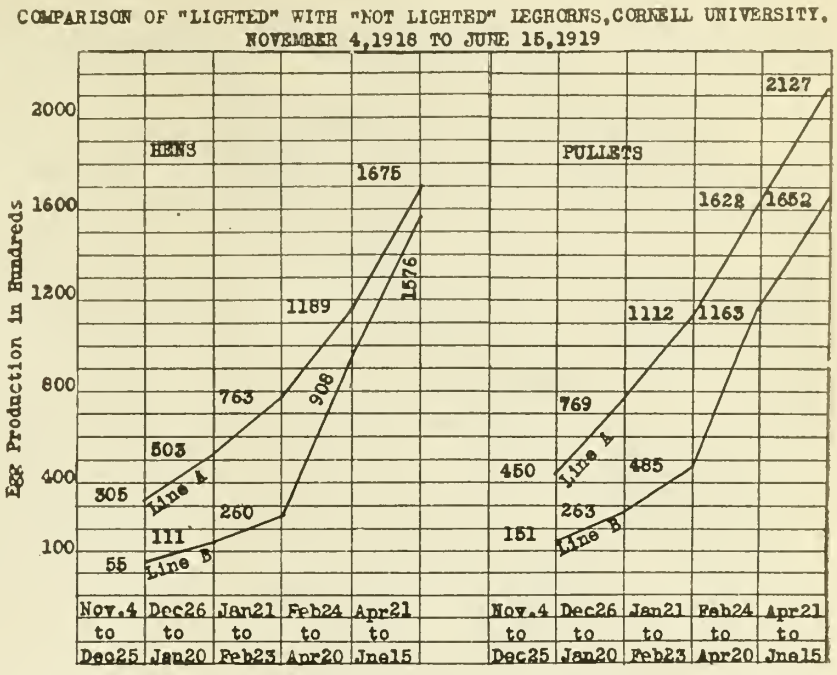
"We shall do our best to introduce this money-making plan throughout the state. We shall get as many poultrymen and farmers to try it as we can, and shall ask them to furnish us reports, using our form of questionnaire, just as a large number have been doing this past fall and winter. Our department is ready to give advice on this subject by correspondence, within the limits of New York State, and whenever it is practicable to do so our men will visit the owners of flocks of considerable size for the purpose of giving them reliable instructions about this matter, also in regard to other good methods of handling their flocks, with the object of getting better results in production and cash receipts."

Lights "Bring On" the 200-Egger

Prof. Rice exhibited two other colored charts, which we came pretty near forgetting—so rich was this feast of poultry knowledge. These two charts were in five colors—blue, red, yellow, purple and black. One represented the egg production of pullets under lights, as compared with a pen of pullets (same age and of same average quality) not under lights. They told an interesting story. Referring to them Prof. Rice said, in substance, among other things:

"In my talk the other day, on distribution of egg production, I stressed the fact that in order to get a high yield for the production year we need 'PRECOCITY.' Now what do the 'lights' do for us? They augment or create this 'precocity.' This is a logical conclusion of early starting, and when we put the lights on in the early fall and the fairly well-matured pullets respond within ten days to two weeks, which is the usual result, we are GETTING 'precocity' by this method—no doubt about it. Within two to four weeks, on the average, we are getting forty to fifty per cent yield, as a rule, under lights, which means that six to eight out of every ten birds have started to lay—and they keep at it, if not pushed too hard. This keeping at it means 'INTENSITY' of production, another factor necessary for high egg production across a twelve-month period or less.

"And all records to date here at Cornell show that the 'lights' give us 'PERSISTENCY' also. For 1918 our tests showed a moderate easing up during the flush season, March to June inclusive, but after that—by August and September—these 'lighted' birds were back at it and it will be remembered that they also did well right through the spring and summer. Here we have the lights contributing, therefore, to 'PRECOCITY,' 'INTENSITY' of production and 'PERSISTENCY'—and these two charts show the results. You will note that blue color means those hens that laid 200 eggs or more within one year. Red means those hens that laid between 175 and 199 eggs in the twelve months. Yellow indicates 150 to 174 eggs and purple from 125 to 149 eggs, while the black squares mean LESS than 100 eggs.



GRAPH EMPHASIZING THE BENEFITS OF "LIGHTS" ON HENS AND PULLETS

This graph is based on the two Cornell tables presented herewith—see page 84. Left half is devoted to HENS and compares the egg production for the period, November 4, 1918, to June 15, 1919, of the "check pen" No. 21 (not illuminated) with Pen 23 that was "lighted" from 3 a. m. till dawn throughout the period and gave the highest results in production during the entire period. Right half is devoted to PULLETS and compares the production of "check pen" No. 20 (not illuminated) with Pen 22, which had the "lights" from 3 a. m. till dawn and that gave the largest egg yield, first to last, throughout the period. In both cases (left half and right half) Line B represents the production of the not-lighted birds, while Line A for each period, represents the yield of the birds under lights—hens in the one case and pullets in the other case. It will be noted, for example, that the hens in the not-lighted pen for this period (November 4-June 15 inclusive) laid 1576 eggs, while the same number of hens (one less in fact) laid 1675 eggs in the same period. By referring to the right half of this chart, it will be noted that the not-lighted pullets during the period laid 1652 eggs, while the lighted birds (exactly the same number) laid 2127 eggs. The cost of "lights" was insignificant, so the records proved. Laying quarters, care and feed were the same in both cases, as near as these factors could be regulated by human agency in a test meant to be fairly conducted.

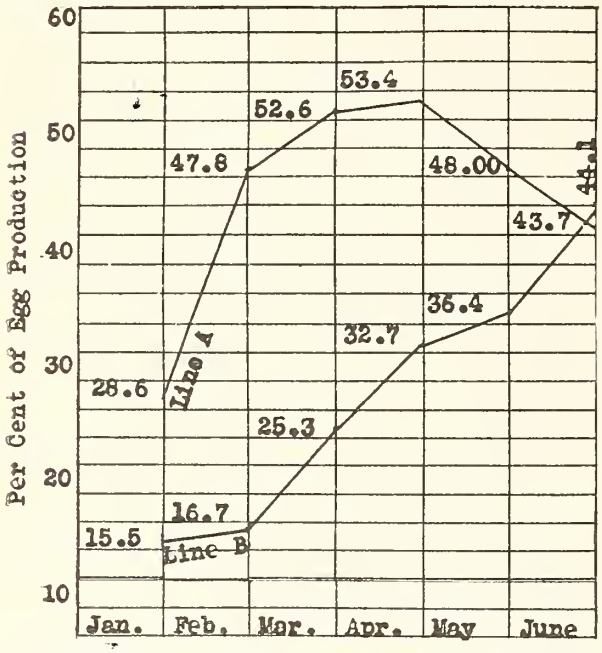
"Now compare the two charts. You will note that 'without lights' NOT A SINGLE ONE of the birds reached the 200-egg mark, although these not-lighted pullets presumably were the equal in every respect of the lighted birds, so far as we were able to judge, and they were housed similarly, fed similarly and had similar care. Over here on this chart that shows the lighted pen of pullets, we find one that shows by the blue checks that it passed the 200-egg mark, laying 223 eggs; that we have two birds that laid from 175 to 199 eggs, as shown by the red marks, averaging 191 eggs; that we have four birds that laid 150 to 174 eggs and that we have twelve among the pen of twenty-five birds that laid less than 100 eggs.

"In the case of another pen of twenty-five pullets under lights, four laid 200 or more, averaging 212; one 175 to 199; three 150 to 174, and only six laid less than 100 eggs.

"Now look at Chart No. II, representing not-lighted birds and note what a large number of them, comparatively speaking, (twenty) laid less than 124 eggs in the 48 weeks. Here there are no 'blue' hens at all! Not one of this lot was able to reach even 140 eggs, the best

five having laid between 125 and 139 eggs; ten laid between 100 and 124, and ten of them laid less than 100 eggs. This low yield from hens without lights perhaps was to have been expected from 'reject birds' that, if it had not been for our decision to put them under lights, would have been sold on the local market for eating purposes.

COMPARISON OF "LIGHTED" WITH "NOT LIGHTED" LEGHORNS AT NEW YORK STATE INSTITUTION



This chart shows in graphic form a comparison of low and high egg production at a New York State institution, as reported by H. E. Botsford, field extension worker of the Poultry Department of the New York State College of Agriculture, as set forth in tabular form on page 86. Line A represents the production (in percentages) of the lighted birds, while Line B shows the percentages from birds of equal merit kept in the same quarters the year before "without lights." Mr. Botsford and the resident manager of this plant attribute the remarkable increase to the benefit of the longer workday given the hens, January 1, 1919, to June 30 inclusive, 1919, by the use of electric light. General care and feeding were the same, or practically so. These good results are in keeping with many other similar tests made throughout the country from the Atlantic to the Pacific, and especially in northern latitudes where the fall and winter nights are longer than in southern territory.

"Results like the above make us wonder whether men or hens are responsible for egg records and suggest the probability that many times the egg records have been the measure of the man rather than the hens. Verily the responsibility of man is great. The responsibility clearly is equally divided between the inherited tendency of the fowl to lay and the methods and skill of the man. Hens have a right to be given a chance to do their best before being consigned to the culling crate and to market. Under better care many a misjudged hen may become a creditable producer. Artificial light, properly applied, is one of the most effective methods of enabling hens to lay what is in them to lay. This will be the hen's greatest joy in life and man's greatest reward in money and satisfaction.

"These results furnish conclusive proof, so it would appear, that the lights immediately and materially improve the birds physically, doing this by helping them to function better, by giving them conditions more natural to their organisms—conditions nearer to their original state when they enjoyed an equatorial day of twelve hours of sunlight on the average for each twelve hours of darkness. Thus far, I am frank to say, in every test we have made here at Cornell in the use of artificial illumination it has been decidedly favorable. This is the fact—and it is information to which you are entitled. As a result of these tests and developments, it is the intention of the Poultry Department of Cornell to put on a state-wide campaign this coming fall in favor of the use of artificial illumination to increase egg production during the period of scarcity and high prices. We believe that we are fully justified in doing this and that the results will be wonderfully helpful to poultrymen and poultrywomen who are keeping fowls for egg production, especially those who keep quite large flocks and look to the sale of market eggs as an important source of income."

Exhibit Showing "Influence of Illumination On Egg Production"

In one of the classrooms in the Poultry Building at Cornell, during the week of the Second Annual Judging and Breeding School, there was a carefully arranged exhibit made up of trays of eggs and placards, the display bearing this title:

INFLUENCE OF ILLUMINATION ON EGG PRODUCTION

Beneath the above wording was the following:

LIGHTS..... { 6 A. M. to Dawn / Twilight to 9 P. M. } vs. No Lights

Average per period; average per bird.

Below the foregoing was the "range of prices" (actual for Ithaca, N. Y., being two cents per dozen less than New York quotations, same dates) from November 28, 1917, to October 29, 1918, said prices being as follows:

November 28 to December 25	69 cents
December 26 to January 22	71 cents
January 23 to February 19	59 cents
February 20 to March 19	43 cents
March 20 to April 16	38 cents
April 17 to May 14	39 cents
May 15 to June 11	43 cents
June 12 to July 9	48 cents
July 10 to August 6	55 cents
August 7 to September 3	61 cents
September 4 to October 1	66 cents
October 2 to October 29	82 cents

On the table or long bench underneath each price placard for the stated period (placards tacked to the wall) were two small trays of eggs, one showing the actual number of eggs laid for the period at Cornell (average) by pullets "under lights" and the other tray showing the average number of eggs laid (under same conditions) by pullets of same quality, not under lights; then at the end of the long table were two big trays, one holding 141.38 eggs (141), representing the actual number laid by the average of the pullets under lights, and the other holding 106.99 eggs (107), representing the number laid on the average by pullets not under lights, and above these trays respectively, was the actual market value (Ithaca prices) of the eggs laid, showing that the average pullet under lights laid $6.31 worth of eggs from November 28, 1917, to October 29, 1918, whereas the average pullet not under lights produced eggs worth $4.43, a difference of $1.88 in favor of the same kind and quality of pullets under lights, given the same feed, care, etc.

Then, along the same table, nearer the front, were two more rows of small trays and two big trays—these representing the same kind of a comparison for hens. The hens under lights averaged to lay 127.9 eggs with an actual market value that year (Ithaca prices) of $5.61, whereas the same kind and quality of hens under lights averaged to lay 101.4, having a value of $4.04, thus illustrating that the hen under lights averaged to earn $1.57 more per bird than did the average hen not under lights; based on the cash value, each month, of the eggs actually laid. And let it be kept in mind that these birds, both the pullets and hens, were rejects, the left-overs.

This exhibit attracted much attention and furnished "favorable evidence" in an impressive form of the surprising—the astonishing benefits of the use of lights dur-

ing the short-day period of the year, beginning as early as September 1st, in the North Temperate Zone and continuing until March 21st, on the average, at which time the sunlit day is equal to the hours of darkness, after which the birds not under lights generally do as well, as a rule, as those under lights, although the experiments at Cornell, November 4, 1918, to June 15, 1919, would indicate that where lights are put on at 3 a. m., for example, and kept burning until dawn, the birds will be so far improved as to health, vigor, etc., that they can be expected to lay even more eggs clear through the spring than birds of equal quality which have not been given the benefit of the longer day and that do not begin to lay until two or three months later, starting perhaps in late January or during February. Such points as this are still to be tested until the limitations are found and rules of practice can be adopted, based on actual results many times repeated.

Tables and Data on Which Eight of Colored Charts Are Based

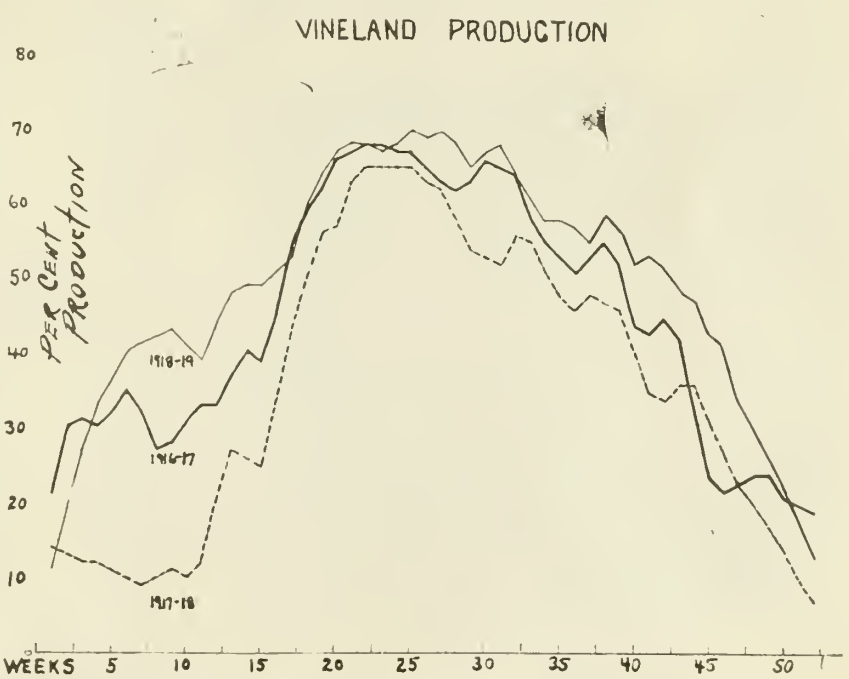
REFERENCE HERE IS MADE TO THE EIGHT THREE-COLOR CHARTS THAT ARE PUBLISHED ON PAGES 6, 7, 10 AND 11 OF THIS BOOK, SHOWING IN IMPRESSIVE FORM PRACTICALLY YEAR-LONG TESTS WHICH WERE MADE BY THE POULTRY DEPARTMENT OF THE NEW YORK STATE COLLEGE OF AGRICULTURE, CORNELL UNIVERSITY, STARTING IN NOVEMBER, 1917, AND ENDING OCTOBER 29, 1918—TABLES HEREWITH WERE OBTAINED BY THE COURTESY OF PROF. JAS. E. RICE, HEAD OF THE POULTRY DEPARTMENT AT CORNELL UNIVERSITY

AS above stated, the tables herewith represent the actual egg production on which eight of the color plates shown in the forepart of this book (pages 6, 7, 10 and 11) are based. The eight tables also present a good deal of additional information that is of interest and value. First, it should be borne in mind that Prof. Rice reported, with reference to these hens and pullets (the entire number under lights during 1918 at Cornell) that they were "rejects"—that is, birds that if it had not been the decision to make the test of the use of artificial light to increase egg production during the fall and winter, would have been sold on the daily market for table meat. These birds, both hens and pullets, were the "left-overs" after all specimens needed for other breeding work and instructional purposes had been picked out of the Cornell flocks.

The foregoing facts explain, in large part, the low average production per hen and per pullet from these S. C. White Leghorns, both without lights and under lights. For hens that are well kept and well fed to average only 100.74 eggs and pullets only 127.94 eggs "without lights," is poor enough, while averages of 113.69, 126.42 and 127.92 for hens "under lights" and averages of 126.59, 127.2 and 147.27 for pullets are averages that would not satisfy the up-to-date fancier-breeder using trap nests, or the progressive commercial egg farmer—not by considerable, although it should be stated that these averages, such as they are, are above the averages for the numerous egg farms of New Jersey, one of our most progressive eastern states in the commercial egg-farming branch of the industry.

These tables (also the colored charts made therefrom) should be studied on a comparative basis—that is, how much better did the lighted hens do than the nonlighted hens, and how much better did the lighted pullets do than the "check pen" of pullets without lights. According to the best judgment of Prof. Rice and his assistants in the Poultry Department at Cornell, all these hens and all these pullets were practically the same, as to their mediocre qualities; they were housed on an equality, and were fed the same, handled alike, etc. On that basis it is fair and enlightening to compare these lighted pens with the nonlighted pens, not only as to eggs laid and percentages of production, but also as to the cost of feed and the value of eggs above cost of feed, thus to determine the approximate benefit of "lights" even on inferior specimens such as these undoubtedly were.

In this same connection it should be taken into account that in no case were the results of these 1918 ex-



GRAPHIC CHART SHOWING WEEKLY PERCENTAGE OF EGG PRODUCTION FOR THREE YEARS AT VINELAND, N. J.

Heavy black line shows pullet production, November 1, 1916-October 31, 1917, inclusive; dotted line shows production of original pullets as yearling hens, November 1, 1917-October 31, 1918, inclusive; lighter black line shows production of pullets, November 1, 1918, to November 1, 1919, these pullets being bred at Vineland from the yearlings here mentioned. Note that the pullets bred at Vineland laid remarkably well the first fifteen weeks of the period; that they excelled their mothers as pullets during the entire twelve months, except for a day or two in the sixteenth or seventeenth week and for two or three days in about the twenty-third week, also for a short period at end of year. Observe that at about the twenty-fifth to twenty-eighth week, these 1,000 pullets touched the 70 per cent production line, which meant 700 eggs per day for a period of several days. This chart contrasts in the clearest manner pullet and yearling production, and emphasizes the inferiority of hens as early winter layers. If they are to be made more profitable at this season, lights must be used, and there is no objection whatever to doing this if the hens are not to be placed in breeding pens later on.

periments equal to the remarkable egg yield secured at Cornell from November 4, 1918, to June 15, 1919, with different lots of hens and pullets, especially those pens (one of hens and one of pullets) that had the benefit of lights from 3 a. m. every morning until dawn. In these 1918 experiments (see tables below) the reject hens and pullets did not hold up so well in egg production during the flush season of the year, namely: March, April, May, June, etc., but in the later experiments at Cornell (November 4, 1918-June 15, 1919) the birds under lights continued to lay more eggs right through the flush season, notably in the cases of pens that had the lights from 3 a. m. until dawn.

NOTE:—Attention is here called to an error which occurred in making the original drawing for Color Plate VIII (page 11) illustrating Table 8. For the period June 13-July 11, the solid production line should be below the dotted line instead of above. The percentage (32.6) is correct.

DATA SECURED IN ONE-YEAR LIGHTING TESTS CONDUCTED BY POULTRY DEPARTMENT OF CORNELL UNIVERSITY AND GRAPHICALLY PRESENTED IN COLORED CHARTS ON PAGES 6, 7, 10 AND 11

TABLE No. 1—PRODUCTION OF CHECK PEN OF HENS WITH NO ARTIFICIAL LIGHT

Cornell University, Ithaca, N. Y.

Hens No Light

Date	Mortality	Eggs Laid	Percent Prod.	Value Eggs	Cost Feed	Value Eggs Above Feed	Feed per Doz. Eggs
Nov. 28-Dec. 25		12	1.7	.69	5.02	—4.33	121.80
Dec. 26-Jan. 22		35	5.0	2.07	5.04	—2.97	45.51
Jan. 23-Feb. 19		130	18.6	6.39	5.44	.95	12.92
Feb. 20-Mar. 19		219	31.3	7.85	5.41	2.44	7.66
Mar. 20-Apr 16	1	369	54.6	11.69	6.01	5.68	5.25
Apr. 17-May 14		395	58.8	12.84	5.31	7.53	4.42
May 15-June 13		362	53.8	12.97	5.11	7.86	4.73
June 12-July 9		310	46.1	12.40	4.91	7.49	5.30
July 10-August 6		289	43.0	13.24	4.52	8.72	5.14
August 7-Sept. 3		224	33.3	11.38	4.16	7.22	6.13
Sept. 4-Oct. 1		80	11.9	4.40	4.71	—.31	19.96
Oct. 2-Oct. 29		27	.40	1.85	3.42	—1.57	45.16
Totals	1	2452		97.77	59.06	38.72	
Averages		100.73		4.02	2.43	1.59	7.80

TABLE No. 2—PRODUCTION OF CHECK PEN OF PULLETS WITH NO ARTIFICIAL LIGHT

Cornell University, Ithaca, N. Y.

Pullets No Lights

Date	Mortality	Eggs Laid	Percent Prod.	Value Eggs	Cost Feed	Value Eggs Above Feed	Feed per Doz. Eggs
Nov. 28-Dec. 25		157	22.4	9.03	6.12	2.91	11.52
Dec. 26-Jan. 22		162	23.1	9.59	5.81	3.78	11.38
Jan. 23-Feb. 19		223	31.8	10.96	6.00	4.96	8.33
Feb. 20-Mar. 19		348	14.7	12.47	7.10	5.37	6.39
Mar. 20-Apr. 16		441	63.0	13.97	7.02	6.95	5.16
Apr. 17-May 14		390	55.5	12.68	5.59	7.09	4.71
May 15-June 11		270	38.5	9.68	4.57	5.11	5.67
June 12-July 9		254	36.2	10.16	5.80	4.36	7.67
July 10-August 6		189	27.0	8.66	4.87	3.79	8.48
August 7-Sept. 3	1	117	17.3	5 95	5.26	.69	14.92
Sept. 4-Oct. 1		62	9.2	3.41	5.06	—1.65	27.83
Oct. 2-Oct. 29	2	50	7.7	3.42	4.31	—.89	30.43
Totals	3	2663		109.98	67.51	42.47	
Averages		107.94		4.46	2.74	1.72	8.23

TABLE No. 3—PRODUCTION OF HENS WITH LIGHTS, 7 A. M. AND 7 P. M.

Cornell University, Ithaca, N. Y.

Hens 7:00 A.M.—7 P.M. Lights

Date	Mortality	Eggs Laid	Percent Prod.	Value Eggs	Cost Feed	Value Eggs Above Feed	Feed per Doz. Eggs
Nov. 28-Dec. 25		80	11.4	4.60	5.85	—1.25	21.54
Dec. 26-Jan. 22	2	150	22.9	8.88	4.98	3.90	10.45
Jan. 23-Feb. 19		246	38.1	12.10	5.95	6.15	7.43
Feb. 20-Mar. 19		296	45.9	10.6	6.11	4.49	6.40
Mar. 20-Apr. 16		373	57.9	11.81	7.25	4.56	6.29
Apr. 17-May 14		336	52.1	10.92	6.05	4.87	5.93
May 15-June 11		297	46.1	10.64	5.18	5.46	5.84
June 12-July 9	1	231	37.0	9.24	4.90	4.34	7.11
July 10-Aug. 6		220	35.7	10.08	4.54	5.54	6.78
Aug. 7-Sept. 3	1	143	24.1	7.27	5.01	2.26	11.53
Sept. 4-Oct. 1	1	79	13.8	4.34	3.85	.49	16.26
Oct. 2-Oct. 29		99	17.6	6.77	4.11	2.66	14.61
Totals	5	2550		107.25	63.78	43.47	
Averages		127.2		5.46	2.77	2.69	7.16

TABLE No. 4—PRODUCTION OF PULLETS WITH LIGHTS, 7 A. M. AND 7 P. M.

Cornell University, Ithaca, N. Y.

Pullets Lights 7 A. M.—7 P. M.

Date	Mortality	Eggs Laid	Percent Prod.	Value Eggs	Cost Feed	Value Eggs Above Feed	Feed per Doz. Eggs
Nov. 28-Dec. 25		153	21.6	8.80	6.14	2.66	11.81
Dec. 26-Jan. 22		214	30.5	12.66	5.57	7.09	8.23
Jan. 23-Feb. 19		309	44.1	15.19	6.23	8.96	6.21
Feb. 20-Mar. 19		387	55.2	13.89	6.53	7.36	5.25
Mar. 20-Apr. 16		405	57.8	12.83	6.18	6.65	4.94
Apr. 17-May 14	1	342	49.7	11.12	6.18	4.94	5.95
May 15-June 11		289	43.0	10.35	4.86	5.49	5.64
June 12-July 9	1	247	38.0	9.88	5.69	4.19	7.74
July 10-Aug. 6	3	217	37.0	9.94	4.26	5.68	6.47
Aug. 7-Sept. 3		159	28.4	8.08	4.03	4.05	8.37
Sept. 4-Oct. 1	1	89	16.3	4.90	4.36	.54	16.48
Oct. 2-Oct. 29		117	21.9	8.00	3.72	4.28	11.22
Totals	6	2928		125.64	63.75	61.89	
Averages		127.2		5.46	2.77	2.69	7.16

TABLE No. 5—PRODUCTION OF HENS THAT HAD LIGHTS DURING EVENINGS ONLY, TILL 9 P. M.

Cornell University, Ithaca, N. Y.

Hens Lights 9:00 P. M.

Date	Mortality	Eggs Laid	Percent Prod.	Value Eggs	Cost Feed	Value Eggs Above Feed	Feed per Doz. Eggs
Nov. 28-Dec. 25		188	26.8	10.81	6.39	4.42	10.03
Dec. 26-Jan. 22		258	36.8	15.27	6.86	8.41	8.45
Jan. 23-Feb. 19	1	249	36.4	12.24	7.46	4.78	9.29
Feb. 20-Mar. 19		287	42.7	10.28	7.73	2.55	8.38
Mar. 20-Apr. 16		354	52.6	11.21	7.17	4.04	6.56
Apr. 17-May 14	1	265	40.1	8.61	6.11	2.50	7.58
May 15-June 11	1	287	45.5	10.28	4.59	5.69	5.36
June 12-July 9	1	234	39.1	9.36	4.95	4.41	7.09
July 10-Aug. 6	1	258	44.5	11.83	5.10	6.73	6.51
Aug. 7-Sept. 3		212	37.8	10.77	4.17	6.60	6.51
Sept. 4-Oct. 1		138	24.6	7.59	4.21	3.38	10.28
Oct. 2-Oct. 29	1	112	20.7	7.65	5.11	2.54	16.26
Totals	6	2842		125.90	69.85	46.05	
Averages		126.42		5.60	3.11	24.9	7.96

TABLE No. 6—PRODUCTION OF PULLETS THAT HAD LIGHTS DURING EVENINGS ONLY, TILL 9 P. M.

Cornell University, Ithaca, N. Y.

Pullets Lights 9:00 P. M.

Date	Mortality	Eggs Laid	Percent Prod.	Value Eggs	Cost Feed	Value Eggs Above Feed	Feed per Doz. Eggs
Nov. 28-Dec. 25		112	16.0	6.44	5.88	.56	15.33
Dec. 26-Jan. 22		333	47.6	10.70	7.30	12.40	6.94
Jan. 23-Feb. 19		370	52.9	18.19	7.98	10.21	6.66
Feb. 20-Mar. 19		375	53.6	13.44	7.61	5.83	6.81
Mar. 20-Apr. 16		368	52.6	11.65	6.55	5.10	5.75
Apr. 17-May 14		296	42.3	9.62	5.54	4.08	6.18
May 15-June 11		267	38.1	9.57	4.23	5.34	5.31
June 12-July 9	1	259	37.9	10.36	5.34	5.02	6.91
July 10-Aug. 6		247	36.9	11.32	5.05	6.27	6.73
Aug. 7-Sept. 3	1	184	27.5	9.35	5.47	3.88	9.82
Sept. 4-Oct. 1		149	23.1	8.20	4.90	8.30	11.23
Oct. 2-Oct. 29		134	20.8	9.15	4.56	4.59	12.18
Totals	2	3094		136.99	70.41	66.58	
Averages		126.59		5.61	2.88	2.72	7.36

TABLE No. 7—PRODUCTION OF HENS THAT HAD LIGHTS, 6 A. M.—9 P. M.

Cornell University, Ithaca, N. Y.

Hen Lights 6:00 A.M.—9:00 P. M.

Date	Mortality	Eggs Laid	Percent Prod.	Value Eggs	Cost Feed	Value Eggs Above Feed	Feed per Doz. Eggs
Nov. 28-Dec. 25		142	20.3	8.16	5.48	2.68	11.21
Dec. 26-Jan. 22		252	36.0	14.91	5.90	9.01	7.38
Jan. 23-Feb. 19	2	222	33.4	10.92	5.15	5.77	7.06
Feb. 20-Mar. 19	2	284	46.6	10.17	5.19	4.98	5.61
Mar. 20-Apr. 16		308	52.3	9.75	5.74	4.01	5.98
Apr. 17-May 14		317	53.9	10.30	4.88	5.42	5.03
May 15-June 11		801	51.1	10.78	4.58	6.20	5.10
June 12-July 9	1	243	42.0	9.72	4.21	5.51	5.78
July 10 Aug. 6	1	231	42 1	10.58	4.24	6.34	6.02
Aug. 7-Sept. 3		156	29.3	-7.93	3.46	4.47	7.30
Sept. 4-Oct. 1	1	110	21.4	6.05	3.87	2.18	11.78
Oct. 2-Oct. 29		137	27.2	9.35	4.80	4.55	12.30
Totals	7	2703		118.62	57.50	61.12	
Averages		127.92		5.6	2.72	2.89	6.84

TABLE No. 8—PRODUCTION OF PULLETS THAT HAD LIGHTS, 6 A. M.—9 P. M.

Cornell University, Ithaca, N. Y.

Pullets Lights 6:00 A. M.—9:00 P.M.

Date	Mortality	Eggs Laid	Percent Prod.	Value Eggs	Cost Feed	Value Eggs Above Feed	Feed per Doz. Eggs
Nov. 28-Dec. 25		256	36.6	14.72	6.65	8.07	7.65
Dec. 26 Jan. 22		380	54.2	22.48	7.26	15.22	6.02
Jan. 23-Feb. 19		381	54.4	18.73	6.88	11.85	5.58
Feb. 20-Mar. 19		420	60.0	15.05	7.07	7.98	5.23
Mar. 20-Apr. 16	1	423	61.8	13.40	6.97	6.43	5.32
Apr. 17-May 14	1	370	55.3	12.02	5.68	6.34	5.04
May 15-June 11	2	264	43.8	9.46	4.03	5.43	5.10
June 12-July 9		192	32.6	7.68	4.65	3.03	8.71
July 10-Aug. 6	1	202	34.8	9.26	4.10	5.16	6.64
Aug. 7 Sept.3		147	26.2	7.47	4.92	2.55	11.04
Sept. 4-Oct. 1		92	16.4	5.06	4.46	.60	16.27
Oct. 2-Oct. 29		159	28.4	10.87	5.75	5.12	12.78
Totals	5	3286		146.20	68.42	77.78	
Averages		145.27		6.46	3.02		6.76

How Mr. and Mrs. Shoup Discovered the Benefit of "Lights"

PLAIN STATEMENT OF HOW THESE TWO EARNEST WORKERS ON THE NORTH PACIFIC COAST, PUTTING IN OVERTIME AND WITH A DETERMINATION TO MAKE GOOD IN THEIR POULTRY VENTURE, DISCOVERED INDEPENDENTLY THAT A LONGER WORKDAY FOR THEIR SHOULD-BE LAYERS MEANT AN INCREASED PRODUCTION DURING THE FALL AND WINTER MONTHS, ALWAYS THE HIGH-PRICED PERIOD FOR NEW-LAID EGGS

By MR. AND MRS. GEO. R. SHOUP, Poultry Specialists, Western Washington Experiment Station, Puyallup, Washington

THE first trial of our artificial lighting of poultry was on a rather limited scale. During the summer of 1911 we had managed to raise some three hundred pullets in fireless brooders. The energy and perseverance required to achieve this result with this crude equipment no doubt led us to an enhanced appreciation of this, to us, magnificent flock of pullets.

Another Leghorn breeder a few miles away also had a flock of approximately the same size. A near neighbor of ours who was well acquainted with this rival producer of eggs took a lively interest in comparing the production of the two flocks of pullets. We had by this time acquired considerable prestige with the pioneer settlers because of our ability to get eggs in the wintertime, an unheard-of proceeding with their poorly housed and worse managed flocks. It was inconceivable to them that an inexperienced Chicago couple, who a few years before had to secure their services to determine the sex of the growing chicks, could really make a living with chickens. So this prestige of being star performers in our chosen line was really quite precious to us. As we look back over this period of our work, we feel that the greatest incentive was not the splendid prices received for the winter product,—though sadly needed for further development, but the pride of performance where the other fellows couldn't.

No doubt the proudest moment of our lives was when driving up the main street of our market town (some forty thousand people) with four cases of eggs—well uncovered, you bet!—and having several aproned clerks and storekeepers following us up to make a bid on the first case-lot of fresh eggs seen in town for several weeks.

Imagine our chagrin one evening when the mutual friend of the rival poultryman and ourselves, after comparing notes, announced that we were beaten fifteen eggs on that day's run. Of course, the other fellow had copped most of our feeding and equipment stunts, but we couldn't believe he had any better pullets. Our star was fading and something must be done.

Our rule in those days, when land had to be cleared, shingle bolts cut and firewood made, was to do no work in daylight which could be done just as well by lantern light. Cleaning the droppings boards was a job that fell among the lantern-lit tasks in the morning. This pre-daylight performance had the additional advantage of keeping the eggs much cleaner, as the birds would fly from the roosts clear to the floor without wanting to jump on the droppings boards and soil their feet.

We had noticed for several days that quite a bunch of pullets would follow up the lantern and endeavor to find grain in the litter, and had on several occasions placed the light on the floor for a few moments just to humor the biddies which, of course, were very tame because of frequent handling in the trap nests. Time was precious, however, and the one lantern was needed to clean more coops before breakfast and to get the oats out of the sprouter and distributed through the coops so that the birds could eat as soon as it was light enough. So when in the course of a Sunday visit, our old English neighbor suggested in a vein of humor that "we give the bloomin' 'ens light to h'eat breakfast and supper by," it gave us the necessary hint. We hung the lanterns (the brightest barn lanterns we could buy) in various places, both high and low, to the rear and to the front of the coop, shifting them to try out the different positions, and finally nailed up tin reflectors on the front foot-wide upright coop supports about two feet from the floor, and hung one lantern in a place. We found it necessary to have the lanterns trimmed and lighted as early as three-thirty in the afternoons, our days were so dark. As a precaution against fire the lanterns when lighted were left on the workbench fifteen or twenty minutes, to make sure the flame did not rise, blacken the chimneys, and possibly come out of the top to the danger of adjacent woodwork.

The birds were so evidently pleased with the new arrangement that we could hear them singing long after dark, and in ten days' time from the purchase of the lanterns we had the pleasure of informing our poultry news dispenser that our production was up to 200 eggs per day, and the country was saved. Mr. C. was still getting the little old five dozen per, which was fifteen 5-cent eggs more than we had been able to squeeze out without the lights. We kept the chicken coops light and the method dark for several weeks. We lived on the end of the road nearly a mile from the nearest neighbor through the woods, but eventually an evening visitor caught us in the act, and shortly all lantern stocks in the near-by stores had disappeared.

At the end of the fiscal year, December 1, 1912, we had hen No. 328 with a 12-month record of 267 eggs. General visitors we found so incredulous that we told only real chicken fans about this bird and her eighteen pen mates, the average of which was 225 eggs. That meant a great deal to us and convinced us that there was a possibility of 200-egg flocks, though not even our imaginations reached the point of expecting the 300-egger. There are

ON R. P. J.'S HONOR ROLL

For some time it has been a practice with the Reliable Poultry Journal to publish illustrations of individual hens that reach an annual egg production of 300 eggs or better, also of birds that pass the 1,000 egg mark in a lifetime. That is what is meant by R. P. J.'s honor roll. The S. C. White Leghorn pictured above gained the right to have her name added to the list by laying 311 eggs in 365 consecutive days in the All-Northwest Egg Laying Contest, Pullman, Wash., year ending in 1918. Unless we are mistaken, no lights were used.

many unsolved problems in building up flocks of high records and long lives, but that only adds zest to the game for the owners of good performers.

In 1915 The Western Washington Experiment Station induced us to transfer our endeavors to state work. We have consistently used the artificial lights of various kinds in the work here. We have this year at this Station gotten about sixty birds, both males and females, having mothers with 12-month records under lights of 280 to 300 eggs and pullet-year (16 months laying without molt) records of 293 to 356 eggs, sired by a 2-year-old cock with a 266-egg mother. These mothers are two and three years old and their second-year records are enough to make common pullets envious, while in point of vigor they all are fit to live to be four or five years old. Not only have these young birds the above backing, but, just as if they needs must show it, they have in a few instances lines of such beauty as could well grace a showroom.

Editor's Comment:—The above interesting account was written expressly for this book on "The Use of Artificial Light to Increase Winter Egg Production," the manuscript reaching the hands of R. P. J. Publishing Company, October 20, 1919. In behalf of our readers and of poultry culture in general we thank Mr. and Mrs. Shoup for the account of their experience and success as pioneers in this productive field.

The particular attention of all readers of this book, who are students of domestic fowl, especially along lines of high-egg production, is directed to the last paragraph of the above article by Mr. and Mrs. Shoup. It is fairly loaded with promise. Undoubtedly a longer workday during the fall and winter months of each season means quicker growth and development on the part of pullets (also cockerels), an increased egg production, and a much larger number of layers that will pass the 200-egg mark, a considerable number of them reaching 250 eggs or better and a limited number reaching or passing the 300-egg mark. Here is indeed a great field for further research and advancement—for record keeping, for proper housing, for correct feeding, etc.—Editor R. P. J.

Comparison of Methods of Managing Pullets for Egg Yields

IN THIS ARTICLE AND THE ONE THAT FOLLOWS, MR. AND MRS. SHOUP, POULTRY SPECIALISTS AT THE WESTERN WASHINGTON EXPERIMENT STATION AND STATE COLLEGE OF WASHINGTON, GIVE EXPLICIT INSTRUCTIONS FOR THE HOUSING, MANAGEMENT, GENERAL CARE AND FEEDING OF WHITE LEGHORN FOWLS "UNDER LIGHTS," KEPT FOR HIGH EGG PRODUCTION—IN THIS ARTICLE THEY COMPARE "GOOD FARM CONDITIONS" WITH THEIR "SPECIAL MANAGEMENT" AND GIVE THE RESULTS IN EGG PRODUCTION—PRACTICAL FEEDING SCHEDULES ALSO ARE GIVEN, WITH COST OF FEED, ETC.

By MR. AND MRS. GEO. R. SHOUP, Puyallup, Washington

EVERY ranch depends upon one or more crops for its cash income, and among other things the raising of a goodly flock of pullets is looked upon as an investment from which cash may be expected. Many are disappointed in the fall and winter returns from these pullets, and if this happens year after year, finally "chickens are chickens, and don't pay anyway."

To remedy this disappointing condition, it is necessary to get the possibilities of the flock clearly fixed in mind. There are two distinct branches of the work that are maintained in every flock, whether recognized by the owner or not, and success depends upon the right handling of these two factors. One factor is the hens or females over one year old, the other is the pullets or females of this season's hatches. The function of the hens is to produce hatching eggs from which the flock is to be renewed. They have passed at least one season of laying and have presumably produced enough eggs to warrant their selection as foundation stock. The function of the pullets is to bring in the cash income during fall and winter, laying enough this first season to prove themselves fit for the breeding flock, and also to give the owner his share of revenue above the cost of feed. Any flock will lay during spring, so that season will not be considered further.

When either the hens or the pullets fail in their functions, the business becomes lopsided and unprofitable. That is, if the hens do not lay fertile, hatchable eggs that give livable chicks, the supply of pullets gives out, and if on the other hand the pullets fail to give fall and winter eggs, the owner's share of the income is a disappointing quantity, often none at all. Just now, the female breeders must be allowed (1) to complete the molt, (2) to rest and recuperate vigor after the year of laying, (3) to exercise and hunt hard to find enough feed to maintain their bodies until spring hatching eggs are wanted.

Can and Should Lay in Winter

For the purpose of showing in a practical way how pullets can be made to lay eggs as they should do, in fall and winter, a demonstration of two ways of handling them was begun at this Station November 9 and continued throughout the season.

A flock of 200 S. C. W. Leghorn pullets, hatched in January, March and May, was holding back on egg production, only 40 being in laying form at the beginning of the demonstration November 9. To make clear the fact that the two parts of a flock, one the fall and winter money makers and the other the foundation flock, are separate and distinct, it is well to state that none but pullets are included in this demonstration.

Two semimonitor houses of like size, 14x28 feet, like construction, and like exposure were used to house the two demonstration flocks. The 200 pullets were so divided that in each flock were placed, November 9:

37 January-hatched pullets, some molting.
39 March-hatched pullets.
24 May-hatched pullets, most of them retarded in growth.

In so far as possible, the birds in the two flocks were alike.

The flock of pullets being handled under what might be termed first-class farm conditions is herein designated as Pen 1. The flock being specially developed to produce the maximum fall and winter egg yield is known as Pen 2.

So taking the two flocks of 100 S. C. W. Leghorn pullets each, the point in question was this: How much money could be made above expenses on Pen 1, and how much on Pen 2? The differences following in both the housing and handling are considered of the greatest importance in showing the relative profit.

Pen 1 was housed in a semimonitor type of house, with open front and without curtain or outside feeding trough attached (see illustrations on opposite page). Surrounding the house is a good green clover patch 150 feet square, and the slide entrance door for the birds was open at all times after 9 a. m., permitting absolute freedom to come and go. Trap nests were arranged under the droppings boards and the perches suspended from the roof. A dry mash hopper, a grit hopper, a shell hopper, and a charcoal hopper were kept open to the flock at all times, as were also clabbered milk and fresh water. Clean straw litter was kept on the floor.

Pen 2 was housed in a semimonitor house, originally an exact duplicate of the one used by Pen 1, but altered as follows for the demonstration(see illustration on page 94). Twelve 18-inch by 24-inch windows were put in the rear wall under the droppings boards, to equalize the light on the floor by day, costing $5.00. An unbleached muslin curtain was hung over the wire net front, with rolling device for raising and lowering it, costing $1.15. An outside mash trough was put the entire length of the front, under the curtain, costing 20 cents. A gasoline lantern was provided for lighting the house mornings and evenings, costing $6.00. The total expense for the material for the above alterations and additions amounted to $12.35, and these may be considered permanent improvements.

The changes were made (1) to give abundant light during working hours, either day or night, (2) to guard fowls against the short, unexpected flurries of wind and storm that interfere with egg production, (3) to lengthen the working day to that of the spring day, (4) to supply regularly on schedule time, in a sanitary way, such materials as were needed to produce the manufactured article, eggs, (5) to develop and maintain the highly efficient winter egg-laying pullet.

The feeds used include oats, wheat, cracked corn, and barley, for hard grain; bran, shorts, wheat middlings, ground oats, corn meal, and soy beans, for ground grain; and fresh blood, ground liver, ground fresh bone, fish meal, meat scraps, and clabbered milk for animal protein. The selection, however, was made as follows and fed at the time indicated.

Feeding Schedule of Pen 1
(Good Farm Conditions)

Daylight:	6 quarts mixed grain, consisting of three parts by measure of wheat, one of cracked corn and one of rolled barley.
8:00 A. M.:	4 pounds clabbered milk, also fresh water.
Noon:	5 quarts ¼-inch sprouted oats, obtained from 2½ pounds dry oats.
3:30 P. M.:	10 quarts mixed grain, same mixture as the morning feed.
All day:	Hopper-fed mash made by measure—1 part bran, 2 parts shorts, 2 parts ground oats, 1 part soy bean meal, 6-10 part meat scraps or fish meal.
	Hopper containing grit, shell and charcoal.
	Free access to clover run.

Cost of Feed per Week, Pen 1

168 pounds mixed grain, at $32.20 per ton	$2.70
17½ pounds oats, at $24.50 per ton	.21½
20 pounds dry mash, at $32.40 per ton	.32½
28 pounds clabbered milk, at 20 cents per 100 pounds	.05½
Total	$3.29½

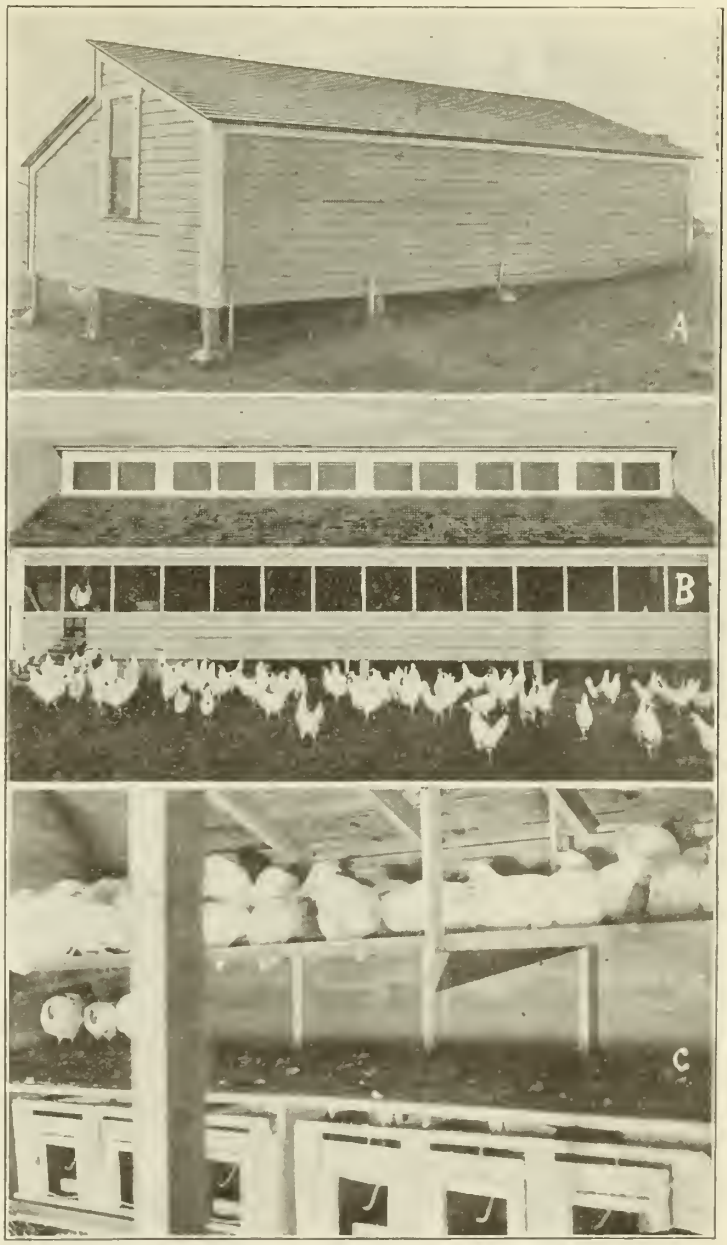
Feeding Schedule of Pen 2
(Special Management)

5:30 A.M.:	Gasoline lantern lighted. Droppings board cleaned.
5:45 A. M.:	16 quarts sprouted oats, obtained from 8 pounds dry oats.
Daylight:	Lantern turned out.
8:00 A. M.:	4 pounds clabbered milk; also fresh water.
3:30 P. M.:	10 quarts mixed grain by measure—2 parts wheat and 1 part cracked corn.
4:30 P. M.:	Lumpy wet mash, 5 lbs. of a dry mash mixture made of 2 parts by measure of coarse bran, 1 part wheat middlings, 1 part corn meal, 1 part soy bean or proteina, 12 quarts of medium-sharp sand to each sack of bran used, ½ part of fish scrap or meat scrap, well mixed, wet with water salted as for cooking purposes. Ten pounds of green bone were used a week in this mash each of the first three weeks of the demonstration. Since then, 2 pounds of green bone has been fed once a week and one pint of fresh blood substituted the other six days.
4:30 P. M.:	Lantern lighted.
5:00 P. M.:	Water.
7:30 P. M.:	Kale—two large stalks or enough small ones to equal them.
8:30 P. M.:	Lantern turned out. Farm lantern hung five or ten minutes to show the way to the perches.
All day:	Bran (coarse) in hopper; also grit, shell, charcoal, in hoppers.

Cost of Feed per Week, Pen 2

105 pounds mixed grain, at $33.60 per ton	$1.74
56 pounds oats, at $24.50 per ton	.70
45 pounds mash (sanded), at $34.40 per ton	.77
10 pounds green bone, at 3 cents per pound	.30
Gasoline, at 3 cents per day	.21
28 pounds clabbered milk, at 20 cents per 100 pounds	.05½
Total	$3.77½

The differences in the management of the two flocks are these—the birds in Pen 1 were supplied with plenty of good food material and permitted to use it when they chose, and were also permitted to get wet feet, wet plumage and to hunt or roam over their patch of clover as they pleased. The birds in Pen 2 were completely under



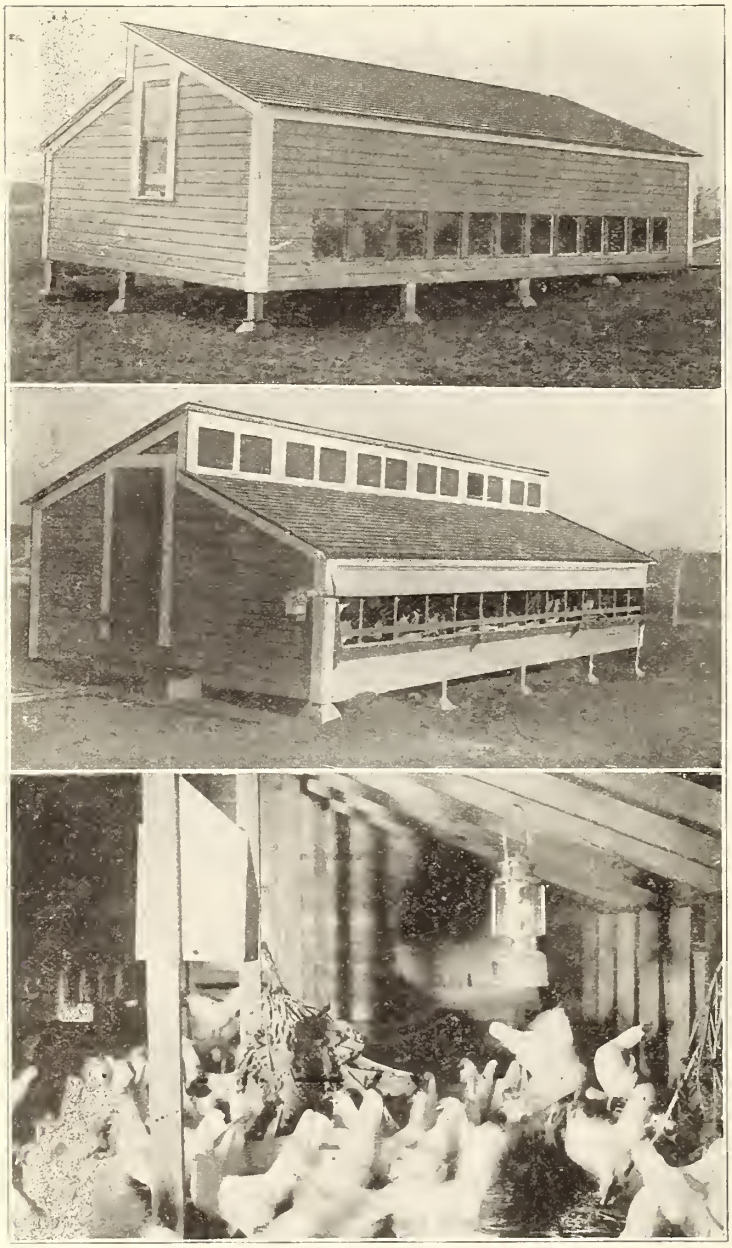
HOUSE USED IN LIGHTING EXPERIMENTS AT WEST WASHINGTON EXPERIMENT STATION

House here shown is the one in which was kept the nonlighted pen in experiment described by Mr. and Mrs. Shoup. A—rear view. B—front view, showing location of windows and open front. C—flashlight view (8 p. m.) with fowls on perches, while their more fortunate companions are still scratching under artificial light eating kale, and getting ready for another productive day. (See illustration on next page.)

the control of the human hand. Their feed was of no better quality than that given Pen 1, but it was somewhat more varied. What and when the birds ate was controlled. They were cordially invited to rise at 5:30 a. m.—inducement: bright light, kale (remainder from evening feed), grain in litter, and perhaps a few bites of mash in the trough. Their morning grain feed was an inviting form of a staple grain (oats) with the indigestible hull softened and the germ alive and growing, almost as good as digging up my lady's flower garden. Being a bulky form of feed it was gone before supper time, so that the appetites were keen for a heavy grain feed at 3:30 p. m. Dessert came on a little later as a balanced ration—wet mash with green bone or fresh blood added, and after a couple of hours of rest their only green feed of the day was offered, with bright lantern light still on. They were told to go to bed at 8:30 p. m. by substituting a farm lantern for the gasoline one. From start to finish they were kept shut in the house and were permitted to do only such things as are known to make for health and egg laying. They were treated as high-grade, well-handled machines, worth the owner's best care and attention.

Each house had twenty pullets in good laying form November 9, and each flock produced three eggs on that day and nine eggs the next. From that time the results began to differ, as shown in the weekly egg records.

The first eight weeks Demonstration Pen No. 1 had the freedom of a yard and had as good conditions both in housing and feeding as the best farm flock. Demonstration Pen No. 2 during the entire time was confined and had special housing and feeding as explained in detail in the January bulletin.



HOUSE OCCUPIED BY LIGHTED PEN IN MR. AND MRS SHOUP'S EXPERIMENTS

This house is similar to the one occupied by unlighted pens (see illustration on page 93) but had a muslin curtain over the open front (partially rolled up when photo was taken), and was provided with windows in rear under droppings platform. Note the gasoline lantern in flashlight view taken at 8:15 p. m. It has been dark outside for about 3 hours but the hens are still busily engaged, eating and taking healthful exercise.

However, to demonstrate that the birds in Pen No. 1 were capable of laying more eggs under gradually increasing advantages, certain changes were made in their housing and management. While December ended with regulation Coast weather, January offered entirely different conditions. It snowed New Year's day and kept it up several days, and up to January 20th snow and unusual cold weather continued.

The birds in Pen No. 1 were so uncomfortable that January 2 it was decided to keep them shut in their house. This had a decided effect, increasing the egg production, as will be seen in the report for the ninth week. Since they could no longer get their own green feed, they were furnished one large mangel or two small ones a day. These were split lengthwise and hung on nails on the end walls of the house, and with one or two exceptions these mangels were supplemented daily with kale.

The continued cold weather and northeast wind made it apparent that the birds would be less likely to freeze their combs and wattles with a curtain over the wire netting front, so one was hung on January 13th. Following this date the feed of sprouted oats was given in the early morning (at daylight), to promote exercise and ward off colds and any sluggishness induced by extremely cold nights.

The water in both houses was kept free from ice, and the chill taken off twice a day by adding boiling water. None of the fowls were allowed to eat anything frozen. The soured milk was taken out of the compartment over the lamp in the oat sprouter and fed at once, which made sure of its being moderately warm.

By these changes added after the unusually cold weather, the egg production in Pen No. 1, instead of falling off, really increased. Pen No. 2 followed the natural course in periods of extreme weather and gradually reduced in egg production, due partly in the tenth week to foul litter. The litter being damp, the sprouted oats and grain froze quickly and were uninviting to the birds. However, the total egg yield of each pen increased, and despite the drop in the market price of eggs, each pen continued to show an advance in profit over the first five weeks.

It will be noticed that there was a reduction in the cost of feed for both the demonstration pens. For the first five weeks the weekly feed cost of Pen No. 1 was $3.29½, while that of Pen No. 2 was $3.77½. For the following five weeks the average weekly feed cost of Pen No. 1 was $3.02, and of Pen No. 2, $3.29. This is almost wholly due to the fact that the January-hatched birds in pullet molt had regained their plumage, and those of the May hatch had fully matured. These two needs were no longer evident, so the ration was changed by slight reductions in various feeds, bringing the total costs down as indicated.

Pen No. 1—Ration Tenth Week

Per day

10 qts. sprouted oats equals 35 lbs. per wk., at $24.50	$ .43
4 lbs. clabbered milk equals 28 lbs. per week, at 20c per 100	.05
10 qts. mixed grain equals 105 lbs. per week, at $32.20	1.69
3⅓ lbs. mixed mash equals 22 lbs. per week, at $32.40	.36
	$2.53

1 large or 2 small mangels (split) per day.
1 large or 2 small kale stalks per day.

Pen No. 2—Ration Tenth Week

Per day

10 qts. sprouted oats equals 35 lbs. per wk., at $24.50	$ .43
4 qts. clabbered milk equals 28 lbs. per week, at 20c per 100	.05
8 qts. mixed grain equals 84 lbs. per week, at $33.60	1.41
6 lbs. mixed mash equals 42 lbs. per week, at $34.40	.72
1 pt. blood equals 1¼ qts. per week, at 25c	.11
Gasoline, 3c a day	.21
	$2.93

1 large or 2 small mangels per day.
1 large or 2 small stalks of kale per day.

Statement—Pen No. 1 (Without Lights)
First Five Weeks

1st week	76 eggs at 45c per doz.	$2.85; cost of feed	$3.29
2nd week	107 eggs at 46c per doz.	4.10; cost of feed	3.29
3rd week	128 eggs at 45c per doz.	4.80; cost of feed	3.29
4th week	155 eggs at 43c per doz.	5.55; cost of feed	3.45
5th week	186 eggs at 42c per doz.	6.51; cost of feed	3.45
652		$23.81	$16.77

Profit over cost of feed, $7.04.

Statement—Pen No. 1—Second Five Weeks

6th week	194 eggs at 38c per doz.	$6.14; cost of feed	$3.45
7th week	191 eggs at 36c per doz.	5.73; cost of feed	3.29
8th week	230 eggs at 34c per doz.	6.52; cost of feed	3.29
9th week	264 eggs at 33c per doz.	7.26; cost of feed	2.53
10th week	270 eggs at 33c per doz.	7.42; cost of feed	2.53
1,149		$33.07	$15.09

Profit over cost of feed, last five weeks..... $17.98
Profit over cost of feed, first five weeks..... 7.04

Total $25.02

Statement—Pen No. 2 (With Lights)
First Five Weeks

1st week	97 eggs at 45c per doz.	$3.64; cost of feed	$3.62
2nd week	223 eggs at 46c per doz.	8.53; cost of feed	3.77
3rd week	392 eggs at 45c per doz.	14.70; cost of feed	4.12
4th week	414 eggs at 43c per doz.	14.84; cost of feed	4.23
5th week	466 eggs at 42c per doz.	16.31; cost of feed	4.23
1,592		$58.02	$19.97

Profit over cost of feed, $38.05.

Statement—Pen No. 2—Second Five Weeks

6th week	485 eggs at 38c per doz.	$15.35; cost of feed	$3.88
7th week	477 eggs at 36c per doz.	14.31; cost of feed	3.36
8th week	463 eggs at 34c per doz.	13.11; cost of feed	3.36
9th week	442 eggs at 33c per doz.	12.15; cost of feed	2.93
10th week	421 eggs at 33c per doz.	11.57; cost of feed	2.93
2,288		$66.49	$16.46

Profit over cost of feed, first five weeks..... $38.05
Profit over cost of feed, last five weeks..... 50.03

Total $88.08

All the station flocks not included in the foregoing demonstration were confined during the month of November, and the open fronts of the poultry houses were fitted with muslin curtains. December 1st found most of the pullets quite well matured but not many of them laying. Most of the hens had completed the molt but practically none of them were laying. December 6th lanterns were hung in all of the houses, and the feeding schedule followed with Demonstration Pen No. 2 was adopted.

The station flocks, not including the demonstration pens, consist of 70 Orpington pullets, 19 Orpington hens, 56 Barred Rock pullets, 20 Barred Rock hens, 247 S. C. W. Leghorn hens, 6 White Wyandotte pullets, making a total of 418.

These birds were in two compartment houses, each breed being penned separately, the hens and pullets of each breed likewise being in separate pens. The weekly production of these birds (286 hens and 132 pullets), beginning December 6, follows:

	1st wk.	2nd wk.	3rd wk.	4th wk.	5th wk.	6th wk.
Hens 144	447	786	989	1,086	983	
Pullets 239	325	487	551	664	524	
Total 383	772	1,273	1,540	1,750	1,507	
Aver. per day.... 54	110	181	220	250	215	

The total egg production of the 418 birds for the six weeks amounted to 20 cases of 30 dozen eggs each. During this period all the flock, both hens and pullets, were fed alike and this will naturally raise the question of the advisability of such a procedure. The need of having practically all the breeders laying showed plainly. These birds had to be gotten into laying prior to the date when hatching eggs will be needed, as the first eggs are liable to run irregular in form and shell. As soon as the Coast weather conditions return, the breeders which have already struck their normal laying gait will be put on the breeders' ration.

When the workday was lengthened for these birds, hens and pullets, by the use of lights, and their ration was adapted to their needs, and fed according to a regular schedule, they began responding at once. While they were giving only a 13 per cent egg yield a day the first week, they yielded 26 per cent the second week, 43 per cent the third week, 53 per cent the fourth week, 60 per cent the fifth week, and 51 per cent the sixth week, notwithstanding that severe winter weather prevailed the last four weeks.

VINELAND INTERNATIONAL EGG LAYING AND BREEDING CONTEST
New Jersey Agricultural Experiment Station
NOVEMBER 1, 1918 - OCTOBER 31, 1919

VARIETY S.C.White Leghorn. RECORD 1 st. YEAR PEN NO 88
OWNER J.Percy Van Zandt. BAND NO 890
OWNER'S ADDRESS Blawenburg New Jersey. OWNER'S NO. 88

19	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	TOTAL MO	TOTAL TO DATE	Weight of Eggs
NOV.		X	X	X		X	X	X	X			X	X	X		X	X	X		X	X	X	X		X	X	X		X	X		23	23	
DEC.		X	X	X		X	X	X	X			X	X	X		X	X	X		X	X		X	X		X	X		X	X	X	22	45	
JAN.		X	X		X	X		X	X			X	X			X		X		X	X		X	X		X	X		X	X	X	19	64	
FEB.	X		X	X	X	2		X	X			X		X		X		X		X		X		X	X		X					18	82	
MAR.	X		X	X	X		X	X	X	X		X	X	X		X	X	X		X	X	X	X		X	X	X	X			X	X	25	107	
APR.	X		X	X	X	X		X	X	X	X		X	X		X	X	X		X	X			X	X	X	X					23	130	
MAY	X	X		X	X	X	X	X	X		X	X	X	X		X	X	X		X	X	X	X	X		X	X	X	X	X	X	26	156	
JUNE	X	X	X	X	X	X	X		X	X	X	X	X			X	X	X	X		X	X	X	X		X	X	X	X			24	180	
JULY	X	X	X	X		X	X	X	X		X	X	X	X	X		X	X	X	X		X	X	X		X	X	X				25	205	
AUG	X		8					0					M																			1	206	
SEPT.	M																							X	X	X		X	X	X		6	212	
OCT.		X	X		X	X		X	X		X	X		X	X		X	X		X	X		X	X		X	X		X			19	231	

DATE	WEIGHT	DATE	WEIGHT	REMARKS
NOV. 1	3.4	JULY 1	3.6	Moult Sept. 1st.
JAN. 1	3.4	SEPT. 1	2.8	
MAR. 1	3.8	OCT. 31	3.6	
MAY 1	3.8			

HEN WITH UNIFORM CYCLES AND UNIFORM RHYTHM

The two terms used above describe respectively, the frequency and regularity of a hen's egg production. The term cycle means the number of eggs that the hen lays without missing a day. Rhythm is the uniformity and rate of repetition of the cycles. The hen whose daily egg record is shown in above illustration began laying in November with a cycle of three eggs—sometimes four, and these cycles were regularly repeated with a uniform lapse of only one day between. During the winter her cycle was reduced to two, but these were repeated regularly with the lapse of only a single day, showing unusually good rhythm during these two months. In the heavy producing season her cycles averaged longer, but rhythmic repetition of the cycles remained highly uniform until the close of her laying period in July.

Card reproduced above is official. (By courtesy of the New Jersey Agricultural Experiment Station.)

NOTE: Above article is reprinted from The Monthly Bulletin of the Agricultural Experiment Station, State College of Washington, January and February 1918.

Essentials for Getting Fall and Winter Eggs

IN THE FOLLOWING ARTICLE MR. AND MRS. SHOUP GIVE GENERAL INFORMATION FOR THE BENEFIT OF POULTRY KEEPERS WHO WISH TO KNOW SOME OF THE EVERYDAY ESSENTIALS FOR SECURING EGGS DURING THE FALL AND WINTER MONTHS, WITH OR WITHOUT "LIGHTS," BUT ESPECIALLY WHERE "LIGHTS" ARE USED—THEY TELL WHAT TO FEED, WHEN TO FEED, AND HOW TO FEED IN ORDER TO GET PROLIFIC EGG YIELDS—THESE TWO POULTRY INVESTIGATORS SPEAK AND WRITE FROM PRACTICAL EXPERIENCE—THEY HAVE PUT THEIR THEORIES TO THE TEST AND THEREFORE ARE IN A POSITION TO GIVE SOUND ADVICE

By MR. AND MRS. GEO. R. SHOUP, Puyallup, Washington

EVERY owner of poultry is vitally interested in getting eggs at this season. It is well worth while to study the flock on hand now (early fall) first to discover its possibilities, and second to provide for its needs. Knowing that the hens can be expected to produce not more than 10 per cent during the next three months shows that the pullets (females hatched this spring) must be the money producers during this season.

The skill shown in mating, hatching and raising this year's flock will now manifest itself in the well-matured, happy, industrious young pullets. The nearly full-grown pullets which have already acquired their winter feathers show, upon examination on the perch at night, full large crops, plump breasts and vigorous muscle development. All such pullets from "bred-to-lay" stock will use to the best advantage the material furnished them for egg making, and where housed and cared for intelligently will lay from 120 to 280 eggs each during the pullet year. By October first, Leghorn pullets should be from five to seven months old, and heavier breeds from six to eight months, for best results.

VINELAND INTERNATIONAL EGG LAYING AND BREEDING CONTEST
New Jersey Agricultural Experiment Station
NOVEMBER 1, 1918 · OCTOBER 31, 1919

VARIETY S.C. White Leghorn. RECORD 1 st YEAR PEN NO. 62
OWNER Hollister Hill Poultry Farm. BAND NO 627
OWNER'S ADDRESS Hollister Mass. OWNER'S NO. 62

19	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	TOTAL Mo	TOTAL To Date	Weight of Eggs
NOV.	X		X	X		X	X				X				X			X	X				X			X	X					12	12	
DEC.	X		X		X		X		X		X	X		X		X				X		X		X		X	X		X		X	16	28	
JAN.		X	X		X		X		X	X		X	X		X	X				X		X	X		X		X		X		X	17	45	
FEB.	X		X		X		X		X		X				X	X	X	X	X		X	X		X	X		X	X				17	62	
MAR.		X	X		X	X		X	X		X	X	X	X		X	X		X	X	X		X	X		X	X	X		X	X	X	22	84	
APR.			X	X	X		X	X		X	X	X		X	X	X	X		X	X	X		X	X		X	X	X		X	X		22	106	
MAY	X		X	X	X		X	X		X	X	X		X	X	X			X	X	X		X	X	X		X	X	X	X		X	23	129	
JUNE	X	X			X	X	X		X	X	X			X	X	X			X	X	X		X	X	X		X	X		X	X		22	151	
JULY	X		X	X		X		X		X	X	X	X	X	X	X	X		X				X			X	X		X	X	X		19	170	
AUG.	X	X	X		X	X	X	X		X	X	X		X	X		X	X	X		X		X	X		X	X		X				21	191	
SEPT.	X																															1	192	
OCT.																																0	192	

DATE	WEIGHT	DATE	WEIGHT	REMARKS
NOV. 1	4.3	JULY 1	4.3	
JAN. 1	4.2	SEPT. 1	4.4	
MAR. 1	4.3	OCT. 31	4.0	
MAY 1	4.7			

EGG RECORD OF A LAYING HEN WITH GOOD CYCLES

The hen whose egg record is presented above laid 192 eggs in a year, and during the heavy-laying season had a cycle of three, repeated regularly with a lapse of only one day between. In the winter, however, her cycles were one and two, and the rhythm also was irregular. Compare this record card with the other two shown herewith, one of which shows much better cycle and rhythm, while the other is decidedly poor in both respects. Card shows actual trap-nest production. (By courtesy of the New Jersey Agricultural Experiment Station.)

Housing

The essential points in housing for winter egg production are:

1. Fresh air.
2. Light.
3. Warmth.
4. Protection from cold winds.
5. Ample hard-surfaced floor.
6. Dust bath.
7. Sanitary conditions.

Fresh Air, the first requisite, is supplied by an opening facing the direction least exposed to the severe storms, combined with that giving maximum sunshine. This opening should extend the entire length of the laying house and should be at least four feet high. The southeast exposure gives the maximum early morning sunshine in this latitude, but east or south exposures will give satisfactory results.

When the curtain is closed, top ventilators are necessary, as sufficient circulation of air cannot be secured through the muslin curtain. These top ventilators should be adjustable to suit weather conditions. Some fresh air must be admitted at the bottom of the coop also, either from the windows under the droppings boards or from some bottom ventilators.

Light is supplied primarily from the front opening, and the coop will be sufficiently well lighted when the curtain is closed, as long as the curtain is clean. When the curtain has become soiled from long usage the light should be supplemented by roof skylights in the peak-roof type of house, and by windows over the opening in the shed-roof type.

When the days begin to shorten so that birds cannot see to eat, artificial lights must be supplied at about 6 a. m. These are used to piece out the daylight both in the morning and evening. The light best adapted for coop lighting where electricity is not obtainable is the gasoline mantle lantern. These produce a very good substitute for sunshine. Do not abuse this lighting program; too much light at night will wear out the fowls.

Warmth is supplied by the hens themselves, consequently the roof must be comparatively low and air-tight to retain the heat.

The curtain also retains the heat of the fowls and is closed every night of freezing or blustery weather as well as during all stormy days.

Protection From Cold Winds. A high windshield in front, even if the opening is narrowed to thirty inches as in a well-known type of house, does not afford sufficient protection from cold winds in winter. Without a curtain the fowls will bunch together under the droppings boards and will cease to exercise more than enough to find the feed

necessary for existence. Whenever this bunching occurs the fowls are uncomfortable and the curtain should be closed immediately.

Hard-Surfaced Floor. The hard-surfaced floor of boards, concrete or asphalt is absolutely necessary to maintain good litter conditions. It has been proved on many occasions that confined fowls will not maintain a maximum egg production without the use of good clean litter, and it is impossible to keep it clean on earth floors.

Dust Bath. The dust bath, which is always accessible to birds when on range, must be supplied indoors when fowls are confined. This must be placed where the direct rays of the sun strike it at some period of the day. The dust can be any loamy dirt which does not pack too easily, and will require frequent moistening. Confined fowls require a certain amount of real mud to eat, and will eat droppings if this is not provided.

Sanitary Conditions. The problem of sanitation is too large to discuss fully in this article. It consists primarily in keeping everything scrupulously clean and free from accumulated droppings, of daily scrubbing the water pails and, most important of all, of removing the litter when it becomes damp.

Feeding

The general principles underlying all systems of feeding are:

First, as much variety as possible and an abundance of feed.

Second, regular times for feeding.

Third, long enough intervals between meals to insure keen appetites.

With Leghorn pullets there is almost no danger of overfeeding, because of their active natures, but with the heavy breeds it is quite frequently necessary to close the dry mash hoppers by 2 p. m. to make sure that the birds will eat enough grain at the evening feed.

Early Morning Feed—To make the best egg record possible, pullets must be induced to get up early and get to work. The sprouted oats are used for the sole morning feed for the following reasons:

First, sprouted oats are more palatable than any other form of grain, and if fed in 4 to 6 inches of dry litter will insure the strenuous exercise required to dry off the sweaty plumage caused by the birds crowding together on the perches for warmth, or to bring up the circulation of those birds that happened to have been too widely separated on the perches. This exercise is the only natural preventive for many of the intestinal and respiratory diseases.

Second, sprouted oats are probably the most quickly digested of any of the available poultry feeds and it is quite important that the morning meal shall have been fully digested and the nourishment assimilated before the afternoon feed of hard grain is given. The fowls are thus certain to have keen appetites.

Third, sprouted oats make a welcome variety to Mrs. Hen's bill of fare, which in too many instances consists of nothing but wheat, varied occasionally by dry oats or kafir corn.

Fourth, sprouted oats are the cheapest known poultry grain in most markets.

Water and Milk. The hen's egg is estimated to be from 68 per cent to 74 per cent water and it is or should be plentiful on every poultry ranch. The experienced feeder will make sure that the birds have fresh water supplied at least twice a day. Clabbered milk is far more palatable than skim milk. If the latter is used, feeders should be cautioned against giving sweet milk one day and sour milk or buttermilk the next.

Buttermilk is preferred to the clabber by some feeders because it is not so palatable and there is no danger of the birds eating too much of it and becoming physiced. Six quarts of clabber to the hundred birds seems to be about the right amount, and if the allowance is limited to this amount there is no trouble from this source. All milk must be fed in clean vessels as a sanitary measure, milk being an ideal culture for the growth of disease germs.

Why the Wet Mash is Not Fed in the Morning or at Noon. The wet mash when fed in the morning is highly relished because the fowls are hungry and wish to fill up with the least possible delay. Because of its consistency it has to be fed in troughs. The birds line up and eat to repletion without one particle of exercise and stand around and loaf all the rest of the day, thus retarding digestion, taking on fat, and frequently catching cold.

Objections to a Square Meal at Noon. Many feeders use the noon hour as the time for feeding the wet mash, and others feed the sprouted oats with long green sprouts or green feed at this time. The principal objection to feeding at this hour is that the edge is taken off the appetites for the afternoon feed and it is very difficult to send the birds to roost with the expanded crop so essential for the eggs the next day. It is no hardship to deny the hens a noon feed, as the dry mash hoppers are before them all the time and they can easily consume enough of this balanced ration to last till the heavy grain feed.

Afternoon Feed—Mixed Grain. The heavy grain is fed in the middle of the afternoon, always in clean, dry litter and early enough so that the fowls will have ample time to exercise and eat all the grain, shell and water which may be required to satisfy their appetites. In winter the amount of cracked corn fed to the laying pullets is increased to about two parts wheat and one of corn, and decreased to the old hens to about one-fourth part cracked corn so that the latter will not take on too much fat. Neither dry oats nor kafir corn is palatable to heavy layers and both are largely wasted in the litter, so even at the increased cost now prevailing, wheat and corn are the cheapest hard grain feeds for egg production.

Early Evening Feed—Wet Mash. Feeding the extremely palatable wet mash, containing a liberal amount of fresh animal food, after the grain feed and just as the birds are going to roost is, we believe, the logical time. By feeding it after the grain there is no danger of the sour or packed crop, as the mash is worked into the hollows between the kernels of grain, and the crop although expanded to the limit is easily flexed by the muscles and the feed is passed on as the various organs require it. The wet mash affords the best medium for distributing and feeding an equal amount of the animal protein to each bird.

Lights for the Poultry House. The cost of artificial lighting varies considerably. Electricity, of course, is the most convenient. At 20 cents a gallon for gasoline, the

VINELAND INTERNATIONAL EGG LAYING AND BREEDING CONTEST

New Jersey Agricultural Experiment Station

NOVEMBER 1, 1916 - OCTOBER 31, 1919

VARIETY S.C.White Leghorn. RECORD 1st YEAR PEN NO. 74

OWNER Oakland Farm. BAND NO. 748

OWNER'S ADDRESS Trenton Junct. New Jersey. OWNER'S NO. 74

19	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	TOTAL MO	TOTAL TO DATE	Weight of Eggs
NOV.		X		X		XX		X		X	X		X			X		X				XX				X		X		X		15	15	
DEC.		X		X		X				X		X			X																	6	21	
JAN.	M																													X		1	22	
FEB	X		X		X		X			X							X		X			XX					X					11	33	
MAR	X		XX		X			X	X	X	X				XXX			X	X				X	X			X	X		X	X	20	53	
APR	X		XX			X	XX				X	X			XXX			XXX				X	XX				XX		X			20	73	
MAY			XX		XX			XX	X	XX			X		XX			X		X		XX							X		X	17	90	
JUNE	X					XX			X	X	X	X	(3)		X			X		XX	X					X		XX				14	104	
JULY	X			X	X		X				X	X		X	X		X		X		X			X			X	X				14	118	
AUG	X				X	X	X	X				X	X							X			X			X							9	127	
SEPT.	M																															0	127	
OCT.																																0	127	

DATE	WEIGHT	DATE	WEIGHT	REMARKS
NOV. 1	3.9	JULY 1	4.3	Moult - Sept. 1st.
JAN. 1	3.7	SEPT. 1	3.9	
MAR. 1	4.2	OCT. 31	3.8	
MAY 1	4.4			

EGG RECORD OF A HEN WITH POOR CYCLES AND RHYTHM

This bird was a poor winter layer and showed no uniformity either in cycle or rhythm, except for a short time during the heavy-laying period. Hens with poor cycles and poor rhythm are rarely, if ever, good layers. Card shows official production. (By courtesy of the New Jersey Agricultural Experiment Station.)

gasoline mantle lights cost about 3 cents a day to operate, or less than one additional egg. These lanterns will throw a sufficiently strong light so that birds can see to eat the grain in the litter 15 feet each side of the lantern, so space lights 15 feet from the end of the coop and 30 feet apart; 40-watt electric lights should be spaced about 20 feet apart to give good results.

Night Feed—Why the Kale is Fed by Artificial Light

Immediately after the wet mash is fed, or before, if the afternoon is very dark, the lights are turned on and biddy is left to her own devices until about half past seven o'clock, when the kale is brought in and fed in racks or suspended from the ceiling. It will be noticed that many of the birds have gone to roost at this time in spite of the brilliant artificial light. The green feed has been kept away from the fowls purposely since about twelve o'clock. If any was left from the night before, at this time it is taken out of the coop. Thus the one thing lacking to complete the full ration is brought on several hours after the crops had once been filled to the limit. All of the roosting fowls are induced to come down and fill up on the succulent green feed. The kale is not a balanced ration in itself, so the birds will also eat a considerable amount of hard grain and dry mash to balance the kale.

Why the Birds Are Shut In

The birds must be confined all the time to the laying house. Do not let them out on nice days, because then they are continually trying to get out on stormy ones and are discontented. After they have once been shut in for four consecutive days they cease to worry about the bug outdoors, and after several weeks of confinement more of them will stay in the house than go out when given the opportunity.

NOTE: Above article is reprinted from The Monthly Bulletin of the Agricultural Experiment Station, State College of Washington, October and November 1916.

Maintenance of Egg Production During Winter

IN THIS ARTICLE THE AUTHORS DESCRIBE AT CONSIDERABLE LENGTH THE PITFALLS THAT ARE IN WAIT FOR OVERZEALOUS OR CARELESS POULTRY KEEPERS, INCLUDING THOSE WHO USE "LIGHTS" AND THOSE WHO DO NOT--NATURALLY IT IS NOT ALL SMOOTH SAILING, OTHERWISE BOOKS OF THIS KIND WOULD NOT BE PUBLISHED AND ALL POULTRY KEEPERS WOULD BE HIGHLY SUCCESSFUL, WITH THE RESULT THAT EGGS FOR TABLE USE AND POULTRY AS HUMAN FOOD WOULD BOTH BE A DRUG ON THE MARKET--INTELLIGENCE AND EXPERIENCE COUNT IN THE POULTRY FIELD, JUST AS THEY DO IN ALL OTHER WALKS OF LIFE

By MR. AND MRS. GEORGE R. SHOUP, Puyallup, Washington

PRIDE goeth before a fall. Just as soon as you take time to congratulate yourself on the exceptionally fine fall egg production you are having, prepare to have the conceit taken out of you by some unexpected condition causing a slump. Even a false molt may overtake you. In anticipation of the natural difficulties augmented by special local conditions, we will review the factors which make high egg production possible in October and November, and then show what to do to keep it up in December, January and February.

Those birds over a year old, of high vigor and good type, with egg records of 150 or more for their first year's laying, are not considered when we speak of fall and winter production, it being assumed that they are going through the molt and resting prior to producing hatching eggs from which next season's laying flock is to come. Do not mix them with your pullet flock of fall and winter cash-income birds.

Review of Method of Getting Fall Production

(1) Use matured pullets, preferably March or April hatched, taken off range and kept constantly in the house until spring breaks.

(2) A house flooded with daylight, well ventilated, having a good dust bath, and an unbleached muslin curtain for the open front; artificial lights to give spring length of day; and ample hard-surfaced floor space covered from four to six inches deep with clean litter.

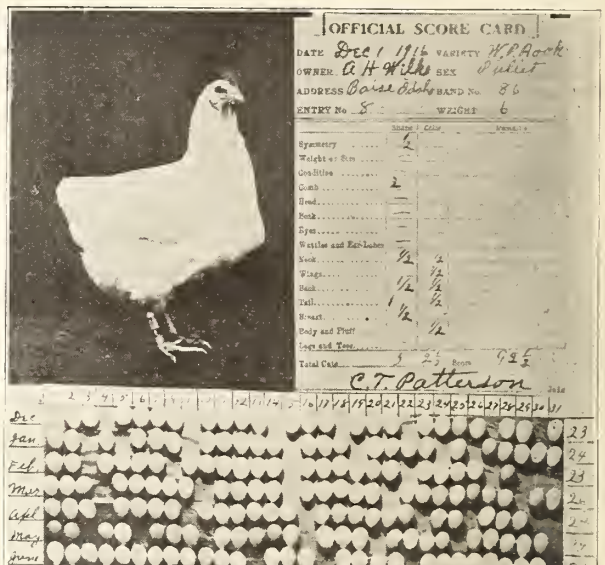
(3) A laying ration in which hard grains, mill feeds, succulent green feed and animal protein are rightly proportioned.

(4) Maintenance of the health of the flock, by sanitation and judgment in feeding and regularity in caring for the birds.

And bear in mind that to get 50 to 70 per cent egg yields from October to December—to bring egg production completely under the control of the caretaker at this time, requires the combination of ALL these factors.

Pitfalls

The first and hardest problem to combat is the danger of a too-high early production. It is only natural, when eggs are soaring and the poultryman has a clear demonstration of the effect of artificial daylight and the



ANOTHER HIGH EGG PRODUCTION WHITE ROCK

This photograph shows a good quality, standard-bred White Plymouth Rock that laid 304 marketable eggs in 365 consecutive days at the Missouri National Egg Laying Contest for the year ending October 31, 1917, as reported by C. T. Patterson, in charge of the contest. This bird, without being put in show condition, scored 92½ points. Note her remarkable production, month by month,. for the year, as follows: December, 23 eggs; January, 24; February, 23; March, 26; April, 24; May, 24; June, 27; July, 28; August, 30; September, 28; October, 24; November, 23. No "lights" are used in these national and international laying contests.

rich animal protein mash, that he will overdo it and crowd the birds past their powers of assimilation. The first danger signs of this condition are:

1. Birds dying from ovary trouble, usually a broken egg in the oviduct, for which there is no cure.

2. Birds becoming lame or totally paralyzed. This ailment is often falsely called rheumatism. It is easily cured by placing birds in a box by a hot stove and allowing their backs to get thoroughly warmed. A ¼-grain calomel tablet for a physic is also used in conjunction with this heat treatment. The afflicted birds should be kept out of the lighted laying house, and all rich animal feeds restricted for a week or ten days, so that they may recuperate. Kale or mangels and sprouted oats are the best diet during this period. The cause of this ailment is thought to be a gas pressure in the intestinal tract due to indigestion, which produces a condition not unlike cramps in humans. This trouble will be more prevalent in cold weather.

Both of these troubles can be largely controlled by reducing the hours of lighting, thus reducing the feed consumption and assimilation; by reducing the amount of animal protein foods and increasing the bulky feeds—short-sprouted oats, and kale or mangels; by the addition of more bran in the mash and a reduction of the corn and wheat proportionately.

The black-tipped comb is a sign of indigestion, usually caused by an unbalanced ration of too much wheat without enough fibrous feed such as germinated oats to carry it through. Too much starch, as in potatoes, shows the same black flag. Usually a couple of ¼-grain calomel tablets will relieve this condition, but the cure is a change of ration.

The white or pale comb is harder to combat. It is a sure sign that the bird is working past her power of recuperation. Too much blood and vitality are demanded by the intestinal tract. A good physic and few days' rest in a quiet place, with non-stimulating feed, is the best treatment.

The birds must maintain a fair amount of flesh on their breastbones to keep up the pace. If the point of the breastbone registers what Mr. Hogan would call "two out of condition," with perhaps one-half or three-eighths of an inch of the bone and skin protruding past the flesh, this is a sure sign that the bird is drawing on its stored-up energy and will have to stop laying so heavily or die.

Another sign of an overtaxed digestive system is the false molt. This will occur more often when an unusually cold January is draining the vitality to such an extent that the digestive organs refuse to work for a period, causing a partial starving of the fowl, which in turn causes a molt.

It is a mistake to try for an abnormal production in very cold weather. It is best at such a time to cut down the animal food and the high vegetable proteins such as soy bean meal and oil meal, and to increase the bulky feeds at the expense of the concentrates.

Cleanliness is a matter of first importance in keeping the fowls healthy and productive. This means clean air, secured by good ventilation. It also means clean litter on either cement, asphalt, or wood floors, and a good dust bath, which reduces the labor of keeping the birds free from lice. The house also must be kept clean by daily gathering the droppings from the droppings boards, scrubbing the water buckets, and frequent renewal of litter. Wet, dirty litter, accumulated droppings left day after day, dirty water and milk dishes, and a hen house infested with mites will make money losers of the best flock of pullets ever raised.

Damp litter is perhaps the greatest menace to continued egg production. Damp, moldy and frozen grain always causes acute indigestion, and such a condition predisposes to the deadly roup, canker and chicken pox.

Roup, canker and chicken pox often start from a cold, and the use of a tablespoonful of the following germicide to each gallon of drinking water is urged for this reason:

Pour one-half ounce of oil of sassafras into one-half gallon of water and shake hard; add very slowly one-half ounce of sulphuric acid. Make this germicide in a glass or stone vessel and keep on hand, using it to keep the birds from getting the infection in the drinking water. Care should be taken that the solution is not strong enough to make the water distasteful, as a lack of water consumption reduces both size and number of the eggs.

Be always on the lookout for colds, which are best detected at night on the roosts. Listen for the sneeze or cough, then identify the bird by the labored and unusual motion of the diaphragm.

HOW CYCLES AND RHYTHM ARE PRODUCED

Thia illustration ahows the egg organa of six hens, also their ovaries removed. At the bottom are given sixty-day trap-nest records made by these pens. This illuatration is presented to show how cycles are governed by yolk development. Hen No. 1, having several yolks rapidly developing at the same time, was able to produce cycles of good length. Along with good cycles thia hen also had fairly good rhythm. Hen No. 6, having neither good cycle nor rhythm was naturally an extremely poor layer. Her inferior performance is easily understood when the condition of yolk development in her ovary is noted. Hen No. 3 alao was irregular in cycle and rhythm, but her cycles averaged longer than those of No. 6. Nos. 4 and 5 had generally uniform rhythm but short cycles. No. 2 was quite irregular in both cycle and rhythm. While her production for the sixty-day period was good and her ovary highly active, her total record for the year could hardly be more than fair at best.

NOTE. Above article is reprinted from The Monthly Bulletin of the Agricultural Experiment Station, State College of Washington, December 1917.

Successful Use of Artificial Light in California

PROFESSOR J. E. DOUGHERTY OF THE AGRICULTURAL EXPERIMENT STATION, UNIVERSITY OF CALIFORNIA, TELLS OF THE USE OF LIGHTS AT THE UNIVERSITY FARM, DAVIS, CALIFORNIA--LATER ON WILL ISSUE A BULLETIN ON THE SUBJECT--REPORT ALSO OF W. T. HADLEY, PROPRIETOR OF OLD IRON SPOON POULTRY RANCH, ONTARIO, CALIFORNIA--IS A STRONG ADVOCATE OF THE USE OF LIGHTS ON THE BASIS OF PROFITABLE RESULTS OBTAINED--FINDS THAT HIS HENS SING, "LET THERE BE LIGHT"

UNDER date of June 14, 1919, J. E. Dougherty, head of the Poultry Division of the California College of Agriculture, replying to a letter from editor of R. P. J., asking for facts about the use of "lights" at this institution, replied as follows:

"It is true that we have been conducting very careful investigations with the use of electric lighting to increase the length of the working day of the laying hen in winter, during the past three years, and this work will be conducted as long as is necessary.

"Among the interesting things which we have learned are:

"First, that the use of electric lighting in the morning only seems to give just as good results as the use of such lighting in the evening only, or both morning and evening. The great advantage of using them only in the morning is that no dimming arrangement needs to be provided, as is necessary with night lighting.

"Up to the present time those fowls on which lights were used at night only, or both morning and night, molted during early spring. Those fowls which were lighted in the morning only have not molted in the spring. We have used the lights as late as 9 o'clock at night and as early as 4:30 a. m. It requires approximately one watt per hen to furnish the necessary illumination, provided the lights are well distributed and supplied with metal reflector shades.

" This is all that we are prepared to say concerning electric lighting tests at this time, but you will find a very complete report of our work to date in the annual report when it is published. There are certain phases of the work which are yet to be cleared up before we will publish any bulletin, and it will probably take us a year or more to clear up these points."

Lighting Hen Houses in Southern California

By W. T. Hadley, Proprietor, Old Iron Spoon Poultry Ranch, and President, Ontario (Calif.) Poultry Association

ALTHOUGH the egg farmer of southern California has had to fight, in many locations, severe eastern winds from the mountain passes, yet for the last nine years he has done so, even at the cost of getting up in the night to lower curtains or windbrakes, and for the last five years the wise ones, when keeping chickens in fruit groves, have placed their houses on the far eastern side of their groves. If you ask them why they do so, they will tell you: "No more southern exposure for us. You get more eggs from an eastern exposure." The still more knowing ones will say: "The eastern exposure puts the rising sunlight right in the faces of your hens and they get off the roosts earlier!"

Some of us learned, years and years ago, that a whitewashed interior that reflected the morning light from wall to wall was far ahead of a black, crude-oil splashed house WHEN IT CAME TO GETTING MORE EGGS. Then there was also the supposedly "poor chicken nut" who arranged numerous bits of broken mirrors and bright strips of tin to reflect the light towards the roosts. And yet we SEE IT NOW—there was method in his madness. He was just about thirty years ahead of the rest of us!

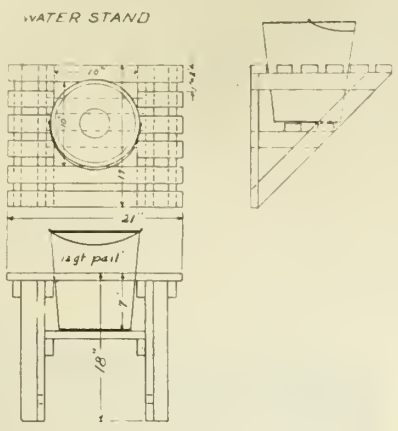
The electric, or white light, has proved itself beyond a peradventure of a doubt. It has come to stay. Of course there are lots of folks that cannot see it yet, even as you will find poultrymen today that will tell you that green food is unnecessary. But the day is soon coming when the breeders and hatcheries will be strong for lighted houses for breeders as well as for layers.

Did you ever get up real early in the morning before

SCENE ON A COMMERCIAL EGG FARM IN PETALUMA DISTRICT, CALIFORNIA

Commercial poultry keeping has developed into an important local industry in different parts of California. Lights are extensively used—always, so far as our information goes, with a good degree of success.

sunrise and see your fowls leave their roosts? If you did do so, did you notice anything? Ever see them stumbling around in the semidarkness, hunting for that miracle worker—the early first drink of water? Ever see them stumbling around eating filth, because they could not distinguish the grain from the filth?



SANITARY WATER STAND

This practical holder for water pail is convenient and easy to make. It keeps the water free from litter and contents are readily accessible. Plenty of pure drinking water must be provided for the heavy-laying flocks.

Early morning rising in the winter means a healthy hen. She has had her morning drink and breakfast, and is on the way to depositing a "ten-o'clock egg" long before the hen in the dark houses knows that a new day has dawned. After several years of "lights" I would have them if for no other reason than this: because I am quite sure that they mean hen-health.

Work Best on Poorer Grade Stock As a Rule

Some of us who are advocates of the lights are afraid that people who quote figures on increase of egg yield do the cause more harm than good. There is no doubt in our minds that lights are a success and that they pay, but there are so many things that enter into an egg yield that folks should be careful how they quote figures. If we accepted the statement of every enthusiast who guaranteed us a ten per cent increase for one reason or another, getting 365 eggs a year would be a common occurrence for the owner of a single hen.

This may seem like talking nonsense, but it means a good deal, nevertheless, because it explains many of the discrepancies in the accounts and figures of the different users of lights. It works out this way: generally th best poultryman will report the smallest increase in egg yield by the use of lights because on account of his knowledge of poultry he would get more winter eggs than the other fellow anyway. If he increases his egg yield under lights eight or nine per cent he is going some. Of course, remember that this is being written in sunny southern California.

There are numbers of our local poultrymen who have sold hatching eggs all July, August and September. These eggs were laid by hens, some of them having been under the light system for four years. Now, the surprising thing is not the sale of the eggs, but the fact that they were fertile and a paying proposition. Not only has there not yet been proof or a scintilla of evidence that the eggs under light systems were not in every way A1 hatching eggs, but a careful observer will now note the wind blowing from the other direction. For example, our own hatching eggs are sold until next June 1st, 1920. This is only mentioned to show that the writer's customers, knowing that all his breeders have been raised from the rustler stage on to four-year-olds under lights are glad to get his eggs at his prices.

I ought to say right here that I do not use the lights evenings at all, and in that way am somewhat of an outlaw on the light question. All of our hens go to bed at nightfall. They are not kept up to graze in the night air. Our lights go on at 3:30 a. m. (old sun time). Any old-timer will notice that when he starts lights his feed bills will go up. His hens will eat more. When that happens it is distinctly up to him and cannot be charged against the lights if he does not have better hen-health and more eggs.

So far as we have been able to ascertain, the men out here who are conservative, hen-wise husbandmen speak well of the lights whenever they have tried them. But conservative men are always slow to try a new thing! They prefer letting the poultry gamblers blaze the trail while they stand pat. Now the time when lights in the hands of a genuine poultryman were a gamble is past. There are many strange notes in the music of the dear little hen. I think, with others, that she also sings: "Let There Be Light."

Later Interesting and Instructive Report From William T. Hadley

Writing editor of R. P. J. under date October 17, 1919, Mr. Hadley said:

"In regard to 'lights,' you notice that I said in the article I sent you earlier in the month that I do not think it best to put the chickens under lights at night, meaning **not too late** in the night. Now I do not have this prejudice 'just because,' but for, to my mind, good and sufficient reasons. It is an axiom that the vitality of every living thing starts to leave its apex and decrease from midday to sunset. Post-mortems on humans prove this every day, everywhere! From noon on, living things begin to exist more and more on their nerve force, until retirement. In the stomach of humans and animals that died in the early morning is found the undigested food of the heavy meal eaten the night before.

"When a creature sleeps or hibernates it is as near dead as it can be without death. The lungs just work enough to keep the heart going. The heart works just enough to keep up circulation. Pretty nearly all the rest of the body is at rest. With our fowls the early morning drink and the early morning hunt for food give the exercise to start things going. It is the early morning exercise that brings hen-health!

FAMOUS OREGON HEN

This hen had just completed a proud record of depositing 303 eggs in trap nests during twelve consecutive months. Was called an Oregonian and consisted of seven-eighths Leghorn and one-eighth Barred Plymouth Rock.

"It will yet have to be proved to me that it pays eventually to overwork **anything** when its vitality is low, except the human brain, and I even have my doubts about that. My experience has taught me that it certainly will not pay with hens, not where maximum egg yield is desired during the annual period of highest prices for market eggs."

Reports on Tests of the "Lighting System" in Canada

INTERESTING AND PROGRESSIVE EXPERIMENTS MADE TO DATE IN THE USE OF ARTIFICIAL LIGHT AT THE CENTRAL EXPERIMENTAL FARM, OTTAWA, CAN., AS PART OF THE DEPARTMENT OF AGRICULTURE, DOMINION OF CANADA--COVER THE USE OF LIGHTS ON BARRED PLYMOUTH ROCKS AND WHITE LEGHORNS, ALSO THE BENEFITS OF ELECTRIC LIGHTS ON SEPTEMBER-HATCHED CHICKS--EGG PRODUCTION RESULTS WERE PROFITABLE IN EVERY CASE AND BENEFICIAL EFFECTS OF THE LIGHTS ON LATE-HATCHED CHICKS WERE TRULY SURPRISING

By F. C. ELFORD, Ottawa, Canada, Dominion Poultry Husbandman.

IN collecting down-to-date material from reliable sources for this book, editor of Reliable Poultry Journal wrote W. R. Graham, Professor of Poultry Husbandry at the Ontario Agricultural college, Guelph, Canada, and President of the American Association of Instructors and Investigators in Poultry Husbandry. Under date, July 30, 1919, Professor Graham replied as follows:

"The electric lights have been under test at the Ottawa Experiment Farm for two or three years. You could get a copy of the report by writing Mr. Elford of the Experimental Farm, Ottawa. The test we made began last fall and of course would not be complete until about the 1st of November of this year.

"We attacked the problem perhaps a little differently, yet at the same time in a manner similar to what the other workers have done and I am not at all sure that we have the final answer yet; that is to say, the work so far would indicate that lights are of considerable value to the majority of laying fowls. I am not positive of their value to birds from high-laying strains, or birds that are hatched in time to be ready to lay when the winter comes along. They are, as I believe, of great value for later-hatched birds and perhaps for old hens."

Acting on the suggestion of Prof. Graham, we wrote Prof. Elford and in due course received the two reports which follow, including the tables that accompany them, for which we thank Professor Elford in behalf of the student-readers of this book.

FOR some time it has been a question whether artificial light in the poultry house was a benefit or not, and to help solve the problem, the Poultry Division of the Experimental Farm made a test during the winter of 1916-17 with two pens of Barred Rock pullets. Another test was made during last winter with two pens of Rock pullets and two pens of Leghorn pullets.

1916-17 Test

During the six winter months of 1916-17 forty Rocks were divided into two pens, twenty of which were given light in the afternoon and evening during the short days. Two tungsten 40-watt lamps were turned on before dusk in the afternoon and turned off at nine o'clock at night. In neither case was the yield heavy, but the lighted pens gave considerably the better results.

The summary of the two pens for the winter of 1916-17 is as follows:

	No. of Eggs	Total Value	Cost Feed	Cost Light	Cost feed and Light	Balance	Cost per Dz.
Light	1106	$54.93	$22.33	$2.40	$24.73	$30.20	26.8c
Dark	636	29.46	21.09	.....	21.09	8.37	39.8c

1917-18 Test

During the winter of 1917-18 forty pullets each of Barred Rocks and White Leghorns were selected and divided into pens of twenty. One pen each of Rocks and Leghorns was given light and the same number kept as checks. The light was turned on the middle of November when the days grew short, a week or two after the pullets were put into their laying quarters. The light was continued until the middle of March when the longer days made the light unnecessary. The light consisted of two 40-watt lamps for each pen of 20 birds. It was turned on at 6 a. m. and left till daylight, turned on again in the afternoon before dusk and left till 9 p. m. They were just ordinary tungsten burners and were turned on and off by hand.

CONVENIENT TROUGH FOR FEEDING MOIST MASH

A daily moist mash is generally fed to hens under lights. Trough shown above, with removable board partition having a sharp upper edge, is easily cleaned, and fowls cannot get into it or perch upon it.

The yields were not high in either case, and the total difference in egg yield in the six months of the 1917-18 test was not large, but the forty birds with light gave a balance over cost of feed and light of $77.64, while the forty without light gave a balance of only $55.95 over cost of feed. This difference was made up on the time the eggs were received. Those with the light gave their heaviest yields in December and January, while by far the heaviest months for the Leghorns without light were March and April and the Rocks January and February.

For early winter eggs during the short days, the light does increase the egg yield, but later in the season the yield is not as heavy as with birds that have not had the light. The advisability of using light, therefore, will depend upon what is wanted. If early winter and high-priced eating eggs are the object, the lights are an advantage; if hatching eggs, the lights are a disadvantage.

The question of degree of fertility also comes in, and though there was practically no difference in this respect in one pen, during the hatching season, we are not satisfied that the light has no injurious effect and shall give it further trial.

The summary of the egg yields, the value and the cost for the various months during the experiment are given in the accompanying tables. The last part of March and the month of April are also included in the tables for the purpose of comparison.

TABLE I—EXPERIMENTS IN THE USE OF "LIGHTS" AT POULTRY DIVISION, CENTRAL EXPERIMENT FARMS, OTTAWA, CANADA

20 White Leghorns With Lights

Month	No. Eggs	Total Value	Cost of Feed	Cost of Light	Cost Feed and Light	Balance	Cost of 1 Doz.
Nov.	71	$ 3.55	$ 4.76	$ .20	$ 4.96	—$1.41	83.8c
Dec.	311	18.14	4.76	.40	5.16	12.98	19.9c
Jan.	276	17.25	5.57	.40	5.97	11.28	25.9c
Feb.	154	9.62	3.72	.40	4.12	5.50	32.1c
Mar.	222	11.10	5.30	.20	5.50	5.60	29.7c
Apr.	215	8.06	3.80	....	3.80	4.26	21.2c
Tot.	1249	$67.72	$27.91	$ 1.60	$25.91	$38.21	28.3c

TABLE II—EXPERIMENTS IN THE USE OF "LIGHTS" AT POULTRY DIVISION, CENTRAL EXPERIMENT FARMS, OTTAWA, CANADA

20 Barred Rocks With Lights

Month	No. Eggs	Total Value	Cost of Feed	Cost of Light	Cost Feed and Light	Balance	Cost of 1 Doz.
Nov.	78	$ 3.90	$ 4.93	$ .20	$ 5.13	—$1.23	79.0c
Dec.	349	20.36	4.93	.40	5.33	15.08	18.3c
Jan.	817	19.81	4.86	.40	5.26	14.55	19.9c
Feb.	193	12.06	5.26	.40	5.66	6.40	36.2c
Mar.	146	7.30	3.15	.20	3.35	3.95	27.7c
Apr.	138	5.17	4.44	....	4.44	.73	38.6c
Tot.	1221	$68.60	$27.57	$ 1.60	$29.17	$39.43	28.6c

TABLE III—EXPERIMENTS IN THE USE OF "LIGHTS" AT POULTRY DIVISION, CENTRAL EXPERIMENT FARMS, OTTAWA, CANADA

20 Leghorns Without Lights

Month	No. Eggs	Total Value	Cost of Feed	Balance	Cost of 1 Dz.
Nov.	16	$ .80	$ 4.65	—$3.85	348.7c
Dec.	123	7.17	4.65	2.52	45.3c
Jan.	157	9.81	4.21	5.60	32.2c
Feb.	165	10.31	5.07	5.24	36.8c
Mar.	312	15.60	5.56	10.04	21.4c
Apr.	322	12.07	4.37	7.70	16.3c
Totals	1095	$55.76	$28.51	$27.25	31.2c

TABLE IV—EXPERIMENTS IN THE USE OF "LIGHTS" AT POULTRY DIVISION, CENTRAL EXPERIMENT FARMS, OTTAWA, CANADA

20 Rocks Without Lights

Month	No. Eggs	Total Value	Cost of Feed	Balance	Cost of 1 Dz.
Nov.	66	$ 3.30	$ 5.59	—$2.29	101.6c
Dec.	184	10.73	5.59	5.14	36.4c
Jan.	281	17.56	4.58	12.98	19.5c
Feb.	257	16.06	6.32	9.74	29.5c
Mar.	166	8.30	5.46	2.84	39.4c
Apr.	193	7.24	3.96	3.28	24.6c
Totals	1147	$63.19	$31.50	$31.69	32.9c

September-Hatched Chicks and Electric Light

Electric light probably shows its usefulness as much as anywhere in the growing of late-hatched chicks. The influence of light on a bunch of September-hatched White Leghorns is here given and, though there was no check, the growth was good and compared very favorably with spring-hatched stock.

A number of chicks were being hatched in September for an exhibit at the Ottawa Fall Exhibition and, though chicks at this time of the year are not recommended, it was thought worth while to rear the cockerels to broiler age and the pullets to maturity.

The chickens were hatched from September 7th to 14th under adverse circumstances owing to the exigencies of the Central Canada Autumn Fair at Ottawa. The eggs were started at the Farm in a Buckeye incubator. They were set so as to hatch each day during the Fair. About 60 per cent of them hatched in the original machine and the chicks were put in a hover at the Fair. The remainder were carried in a grip to the Fair and placed in a Cyphers machine to finish. A number of the eggs were again removed, as they "pipped" into an observation incubator so that the visitors to the Fair could see the completion of the process of hatching. When the chicks dried off, they were placed in a Buckeye coal-burning colony hover which had been fitted up for heating by an electric lamp, as coal could not be used in the building. The chickens spent the week of the Fair in an open run eight feet square in the exhibition hall. On September 14th, they were taken from the Fair to the Farm during very wet weather and on arrival were weighed (21 lbs. 14 oz.) and put under a colony hover, electrically heated, as at the Fair.

During the week of the Fair, the chicks were fed five times a day on a mixture of toasted bread (ground to a powder), chick-size grit, ground charcoal and hard-boiled eggs. In addition to this they received all the buttermilk they wanted, and a dry mash of bran and ground beef scrap was before them all the time. During this week it was noticed that there were always some of the chicks feeding at all hours of the night, the light from the lamp used in heating the brooder enabling them to see the feed. When the chicks were taken to the Farm they were fed the first two weeks, in addition to the above, a good heavy meal of scratch feed each night at ten o'clock. This night feed was appreciated so much that it was made a permanent affair. From the third to the sixth week the ration was chick feed in litter, and a mash consisting of equal parts of bran, sifted oats, and beef scrap was before them all the time. Buttermilk was given ad lib., and grit, shell, charcoal and beef scrap was always in an available hopper. No water was given. From the seventh to the tenth week, the feed consisted of ordinary scratch feed four times a day, with a dry mash of equal parts of bran, sifted oats, cornmeal and half-part linseed meal, before them all the time.

COST OF RAISING 215 CHICKENS FROM SEPTEMBER 14 TO DECEMBER 6, 1918

Hatched Week Ending Sept. 14 at the Autumn Fair

Weight Sept. 14, 215 chickens	21 lbs. 14 oz.
Weight of 108 pullets Nov. 5	123 lbs.
Weight of 100 cockerels Nov. 5	130 lbs.
Total	253 lbs. 14 oz.
Weight of 101 pullets Dec. 6	216 lbs.
Weight of 100 cockerels Dec. 6	228 lbs. 4 oz.
Total	444 lbs. 4 oz.

On Nov. 5th the pullets and cockerels were separated, and on Nov. 16th the latter were placed on a fattening ration which was continued until Dec. 6th, when they were sold. Gains made by the cockerels during this period were as follows:

100 cockerels put on fattening ration Nov. 16—weight	169 lbs.
100 cockerels ready for sale on Dec. 6—weight	228 lbs.
Gained	59 lbs.

DEBIT		CREDIT	
Feed		Sale of 100 ckls.	
Scratch feed, 1131 lbs., $72 ton	$40.72	205 lbs. (Live weight, 228 lbs.)	$102.50
Bran, 125 lbs., $40 ton	2.50		
Linseed meal, 12 lbs., 5 cents per lb.	.60		
Beef scrap, 128¾ lbs., 5 cents per lb.	6.44	101 pullets on hand (216 lbs.) valued at $1.25 each	$126.25
Sifted oats 94½ lbs. $1.10 per 34 lbs.	3.06		
Crusbed oats, 50 lbs., $3.25 per cwt.	1.63		
Cornmeal, 134 lbs., $3.25 per cwt.	4.36		
Oatmeal, 134 lbs., $5.00 per cwt.	6.70		
Ground sereenings, 134 lbs., $2 per cwt.	2.68		$228.75
1943 lbs. 4 oz.	$68.69		80.85
Milk, 2205 lbs. at 50 cents per cwt.	11.08		$147.90
Grit, sbell, charcoal, 36 lbs. 3c per lb.	1.08		
	$80.85		
Value 215 chicks, 1 week old @ 25c	$53.75		
Total cost at time of selling	$134.60		
Bal. of transaction less cost of light	$ 74.15		

VIEW OF PORTION OF POULTRY PLANT ON CENTRAL EXPERIMENTAL FARMS, OTTAWA, CANADA

Central Experimental Farms is part of the Dominion Department of Agriculture. It was here that the experiments in use of "lights" referred to in this article were conducted.

Use of Artificial Light in European Countries

EVIDENTLY TO DATE (LATE IN 1919) EUROPEAN COUNTRIES HAVE DONE PRACTICALLY NOTHING IN THE USE OF ARTIFICIAL LIGHT IN POULTRY HOUSES TO INCREASE EGG PRODUCTION DURING THE SHORT-DAY PERIOD OF EACH SEASON--HEREWITH IS INFORMATION ON THE SUBJECT AS COLLECTED FOR PUBLICATION IN THIS BOOK

By MR. EDWARD BROWN, F. L. S., London, England.

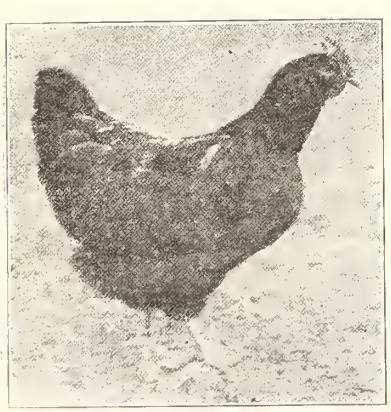
UNDER date of April 23, 1919, Mr. Edward Brown, London, England, Europe's leading authority on poultry subjects of a practical nature, replying to a question asked by editor of R. P. J., wrote as follows:

"So far as use of 'Artificial Illumination to Increase Winter Egg Production' is concerned, I am unaware of any experience in that direction (over here) up to the present, but anticipate that the system will be given a trial. For that reason I have paid a good deal of attention to it during my last two visits to America, in 1917 and 1918. The evidence obtained was remarkable, and I saw it both east and west. Also I have followed very carefully the articles on the subject appearing in R. P. J. There are several factors in connection with it which deserve careful observation and experimentation, more especially as to the breeding value of birds so treated. I was somewhat surprised to learn that in one or two cases there had been no harmful influence in that direction, as the weight of evidence appeared to be the other way. How far it must be reserved for layers and only layers is the point."

ADDRESS BY MR. BROWN BEFORE INTERNATIONAL POULTRY CONFERENCE

London, England, March 11-15, 1919

March 11-15 in London, England, was held an International Poultry Conference, under the auspices of the International Association of Poultry Instructors and Investigators, at which conference Mr. Brown read a paper or made a report, as follows, on the use of artificial light in poultry houses in the United States to increase egg production:



WORLD EGG RECORD

To the best of our knowledge, that title and honor belongs to this Black Orpington hen illustrated herewith. She laid 335 eggs in 365 days at the Australian Government Egg Laying Contest. Her eggs averaged 26½ oz. doz.

"Then another point which troubles us here, just as much as everywhere else, is that hens, in spite of all we do, taking them in the main, will lay more eggs in spring than in the winter. If hens would only lay when eggs were dearest in price, everyone would make more money. Some ten years ago, Mr. Shoup, whom I met in the State of Washington, discovered that when poultry houses were lighted morning and evening he got many more eggs. From that fact there has been developed a system which has had the most marvelous results.

"I cannot now go into the details, but found east and west—more in the west than in the east, but it is increasing there—that the commercial poultry farmers in their large houses are lighting them either by electric light, acetylene gas, or ordinary lanterns and the results are remarkable.

"One man, who has carried this out at East Aurora, in the State of New York, for four years, told me that when he first thought of testing it he had something like 2,100 pullets, and he did not want to risk his best birds, so he selected the inferior specimens. At the time—the test commenced on December 2—these were laying twenty per cent, that is, he was getting twenty eggs per day per hundred hens. They then were subjected to the electric light, that is, 500 of them were. I may say that 1,600 hens, the best hens at the time of the beginning of the test, were laying thirty-five to forty eggs per day per hundred hens. There came a sudden spell of winter weather—and you do get winter weather over there; I experienced twenty degrees below zero last February—and they had a severe spell. In spite of that, the egg production of the 500 hens that had light rose in three weeks from twenty per cent to sixty-five per cent; that is to say, he was getting sixty-five eggs for every hundred birds. On the other hand, the egg production of the 1,600 hens which had not the light fell to twenty per cent, a little more than half. So convinced was he by these facts that he applied the system of lighting all around.

"Another man told me at Alfred, in New York state, that he was getting from 200 hens early in December only sixteen eggs per day. After ten days of artificial light the number had risen to thirty-three, and after twenty-three days to one hundred and sixty-six eggs per day, as the result of an application of light. I could give you a large number of examples of that kind. In the state of Washington it is said there is not a farm that has more than one hundred hens which does not apply light in winter. IT IS A TRANSFERENCE OF PRODUCTION FROM THE SPRING TO THE WINTER.

"This system, so far as now is known, should not be used for birds that are intended for breeding. As one man said: 'It knocks molting into a cocked hat.' It is purely artificial, and I should not advise anyone, from the observations made, to select any of those lighted birds for breeding; treat them as layers, and when they have completed their tale of eggs they will have done their work.

"The system usually adopted is this: Where electric light can be used they fix a switchboard, on which there are alarm clocks. This is set during the day, and as soon as it becomes dusk the light comes into action, and immediately the whole shed is illuminated; it remains illuminated until eight o'clock, when there is just enough light left to show the birds where the roosts are, and ten minutes later another clock operates and entirely puts out the light, which is turned on automatically the next morning at 5:30. Thus the period of work during the winter is extended to something like sixteen hours a

day, and the result is, as stated, that there is an enormously increased production of eggs in winter.

"I hope that some of our colleges or other leading places in this country will give that system a test, because if we could transfer some hundreds of millions of our eggs from the spring to the winter it would be better for the industry all 'round. It apparently is not a question of increased numbers, but of transference and equalization of production."

An Honorable Member: "I should like to ask, with regard to these experiments in artificial lighting, whether it has been proved in the States that by inducing these birds to lay in the winter to a greater extent, it does increase the annual production of the fowl?"

Mr. Brown: "So far as my observations go, it does not increase the annual production. There does not seem to be any evidence in that direction; it is mainly a question of transference from one season to another."

Mrs. Fawkes: "Perhaps Mr. Brown would tell us whether in America they apply the light to houses without glass in the front. When I built a house for 140 birds I was able to put on electric light, but owing to the war we could not get it, so I fitted the front of the house with glass, and the result has been that our best hens have laid twenty-six eggs each per month during November, December and January, and we find the glass has had the same effect practically as the electric light. Probably in America the houses are without glass."

Mr. Brown: "In America they do not use much glass in the houses; most of them are open-fronted houses, and they use curtains and not much glass, if any. I was in only one or two places where they had glass, and it was not for that purpose."

A Delegate: "I take it that really the reason this artificial light is applied, and the reason they secure a greater output of eggs, is that the fowls have longer hours and consume more food—that is, during the short winter days the fowls do not have much time for this?"

Mr. Brown: "Some observations made at Cornell University were to the effect that in the winter months, when the birds went to roost at 4:30—in those birds, no matter how you fed them, their crops were empty at midnight. They then had to go for seven or eight hours before further food could be obtained, and by continuing the hours of working to 8 p. m., and putting artificial light on at 5:30 a. m. they obtained sufficient food."

ANOTHER FOREIGNER

For ten to fifteen years, in England, Australia, and New Zealand they have been working systematically to secure high egg production from domestic fowl. In an egg laying contest held at Shirley, Christchurch, New Zealand, under the auspices of the New Zealand Utility Club, the S. C. White Leghorn shown above laid 317 eggs in trap nests in 365 consecutive days.

Mr. Robinson: "I should like to know whether Mr. Brown has had any experience in America of the use of colored glass or colored light?"

Mr. Brown: "No."

Captain Clarke: "We have had a few experiments at the Central Experimental Station at Ottawa (Canada) in connection with artificial lighting. The houses were curtaincd and had glass. I have the figures in front of me. A pen of twenty White Leghorns, with light, starting with 71 eggs in November, in Decemher they gave 311 eggs, whereas a pen of twenty Leghorns, without light, gave 15 eggs in November and 123 in December. In this particular experiment there was a total of over 266 eggs in the two pens in favor of the artificial light."

Mr. Robinson: "How did it work out economically?"

Captain Clarke: "The eggs were laid at a time when the price was high. With light the balance was $1.41 in November and $12.89 in December. Without light it was $3.85 in November and $2.52 in Decemher. I have a complete set of figures here, if any person is interested."

Mr. Brown: "In that respect, one practical farmer in New York State told me: 'I have been a poultry keeper for fifteen years and had never been able to show a balance of profit over my food costs in the months of November, December and January'—that is, by his ordinary work. 'But,' he said, 'these last three years in which I have used this lighting system every one of those three months has shown a handsome profit over the feed cost. There is no month in the year now that I cannot show a profit over the expenditure for feed.'"

Mr. Prain: "With regard to the question of electricity, we carried out experiments at our place last year in electro-culture. We obtained a small generator, and were able to get along very well as regards light and to carry out experiments. I would like to recommend that as a cheap source of electrical supply."

ENGLISH POULTRYMAN ADOPTS ARTIFICIAL LIGHTING

In this connection we are pleased to present the following extracts from a letter of date, June 22, 1919, addressed to editor of R. P. J. by Mr. John Hart, Proprietor of Kenmore Egg Farm, Charing, Kent, England:

"My calculations are based on the many articles published in your valuable columns. At first I doubted, but R. P. J. made me go into it. During the war it has been impossible to get a lighting plant. My installation will be a 4 kw. direct-coupled set running on paraffin and a full battery to take about 25 amps. more than the full estimated load. The light will be turned on at 4:30 a. m., by automatic time switch. During working hours the switches will be hand controlled. At 8 p. m. the automatic time switch will turn on a small blue lamp and extinguish the 200-candlepower lamp and after about twenty minutes will extinguish the blue lamp. This I find is better than using a dimmer.

"Mr. Edward Brown, who endeavored to assist me obtain a plant during the war, is somewhat doubtful of the effect on the genetic power of the hens during their second season when used for breeding. Experience only can solve that problem.

"On this farm we have three testing houses, each holding 250 birds, trap-nested for four months. I purpose cutting off the illumination from one of the three in order to prove the claims of the power of light over darkness. My manager, who will select the 750 pullets from range in order to make the next season's breeding pens, will not be aware which house I expect to cut out, as this last is more for my own use than for others. The details will however be supplied you in due course."

Several Private Users of "Lights" in New York State

ERIE COUNTY WOMAN'S EXPERIENCE WITH ONE HUNDRED BIRDS--LIGHTS "SAVED THE DAY" FOR HER FLOCK--REPORT FROM FIRST MAN TO USE LIGHTS IN ALLEGHENY COUNTY--MANY HAVE FOLLOWED HIS LEAD--SUCCESS OF MAN IN ORLEANS COUNTY--THESE MEN USED ORDINARY LANTERNS AND OBTAINED GOOD RESULTS, START TO FINISH--HOW LANTERNS WERE USED--CONCLUSIONS BASED ON SEVERAL YEARS EXPERIENCE

FOLLOWING are sample letters received by Reliable Poultry Journal from poultrymen living in New York State who have used "lights" successfully in obtaining largely increased egg production during the short-day period of the year, usually from middle or late fall to the following early spring:

Letter of Rosa A. Mesner, Hamburg, (Erie County) New York

Hamburg, New York, Aug. 10, 1919.

Editor Reliable Poultry Journal:

Your kind favor of July 29th came to me and I wish to thank you for asking my advice on the use of artificial light to increase egg production. I do not try to handle more than one hundred laying hens, for the reason that I am crowded for room. Prof. Rice is a wonder and I wish we had more men like him in the poultry industry. I credit much of my success to his help.

When I joined the Cornell Poultry Project in this county two years ago, I knew nothing about the keeping of poultry, but acting on Mr. R. S. Moseley's very kind advice, I purchased a good strain of S. C. White Leghorns and followed directions as to feeding. When November came I got so few eggs that it was hardly worth bothering with chickens, but the work kept me outdoors and my health began to improve, so I weathered through the winter.

The next fall Mr. Moseley advised the use of electric lights. I could not get a man to put them in for me, but the next spring I had the lights put in for use the coming fall. Now for the excellent results:

From October 1st to November 1st, 1917, I got 63 eggs; from November 1st to December 1st, 248 eggs, doing this without "lights"; then I put on the "lights" and during December I got 558 eggs; during January, 904; during February, 1020; during March, 1258; in April, 1507; in May, 1398; in June, 1143; in July, 1153; in August, 841; and in September, 286.

October 22, 1918—early that year—I put on the "lights" and from practically the same number of birds I got 689 eggs in November, 1149 in December, 1272 in January, 1139 in February, 1622 in March, 1279 in April, 1385 in May, 1291 in June, and 856 in July.

You can see for yourself, therefore, what the "lights" have done for me with my small flock of one hundred birds. Let me say one thing: I only put my lights on at 4:30 a. m. and again in the evening up to 8:00 p. m. For this season I have not yet begun using them, but I shall start again October 22nd of this year.

Respectfully yours,

(Signed) ROSA A. MESNER.

Letter of C. H. Palmer, Proprietor, College View Farm, Alfred, New York

Alfred, New York, August 19, 1919.

Editor Reliable Poultry Journal:

I received your letter some time ago and will now endeavor to comply with your request. I began using the "lights" December 13, 1917, being the first man in Allegany County to give the "lights" a fair trial, though two others in this neighborhood tried them a short time.

That year I had two hundred S. C. White Leghorn pullets, early-hatched birds, from which I hoped to get a lot of winter eggs. They began laying in November (very few in October) and during that month got as high as forty eggs a day, but as the days grew shorter they reduced the number of eggs until I got only fifteen one day and nineteen the next—on December 11th and 12th.

December 13th I put on the lights and following is the record of their egg production the next twenty-three days: 15, 13, 16, 17, 15, 13, 19, 17, 29, 27, 33, 36, 42, 54, 71, 80, 96, 112, 122, 132, 141, 144, 148.

Another hundred pullets, later-hatched birds, that were laying no eggs at all, were put "under lights" December 20th of that year and following is what they did: 21st 2 eggs, 22nd 3 eggs, 23rd 2 eggs, 24th 5 eggs, 25th 3 eggs, 26th 9 eggs, 27th 7 eggs, 28th 5 eggs, 29th 10 eggs, 30th 12 eggs, 31st 15 eggs, Jan. 1st 21 eggs, Jan. 2nd 27 eggs, Jan. 3rd 28 eggs, Jan. 4th 29 eggs, Jan. 5th 31 eggs, etc.

January 24, 1918, I tested the use of "lights" on 180 old hens. Here are the results: Jan. 20th 9 eggs, Jan. 21st 15 eggs, Jan. 22nd 18 eggs, Jan. 23rd 15 eggs, Jan. 24th 16 eggs, Jan. 25th 17 eggs, Jan. 26th 23 eggs, Jan. 27th 25 eggs, Jan. 28th 23 eggs, Jan. 29th 32 eggs, Jan. 30th 34 eggs, Jan. 31st 47 eggs, Feb. 1st 40 eggs, Feb. 2nd 72 eggs, Feb. 3rd 66 eggs, Feb. 4th 77 eggs, Feb. 5th 85 eggs.

At that time two of my neighbors caught the idea, and one got two eggs from 200 hens and pullets the day "lights" were put on, and on the 24th day he collected 124 eggs from these hens and pullets. The other neighbor got 24 eggs the first day at the time of putting on the "lights", from 220 hens and pullets, and on the 20th day "under lights" he gathered 146 eggs.

All five of these tests were made with oil lanterns that were lighted at 6:00 a. m. and kept going until daylight and were again lighted before dark and kept going until 8:00 p. m. The hens were fed very sparingly with grain in litter until 6:45 a. m., when a warm moist mash was fed, then they were given all the grain they would eat. Each evening they were fed again at 7:00 p. m.

I began this work before Cornell took it up and have been very much interested in Prof. Rice's late tests. I "lighted" last winter 668 average-quality hens and pullets. Began using the "lights" October 1st and from this number of birds gathered 992 eggs in October, 5295 in November, 6986 in December, 5883 in January, 4727 in February, 6048 in March, 3982 in April, 5333 in May, and 7767 in June. A comparison of the same months for the years 1916-1917 when I did not use "lights" will show the difference in number of eggs.

Allowance of course is to be made in the difference in the number of hens. Those two years the average number of hens was 371 and here is a report of the actual number of eggs gathered: October 601 eggs, November 388,

December 885, January 1302, February 1933, March 6456, April 8366, May 8775, June 7180.

Here is a comparison of the financial results:

1917—One Year Without Lights		1918—One Year With Lights
$1.43	Profit per hen	$3.70
3.41	Cost of feed per hen	4.48
117	Number of eggs per hen	152

These profits in both cases credit the hen with all eggs (less incubator eggs) at average prices, also fowls sold, fowls eaten, and value of manure, and charges her in each case with all feed, litter, etc., also interest on investment, and a labor charge of $1.00 per hen.

Now as to conclusions regarding the use of "lights":

First, it pays a big profit to "light" all pullets.

Second, it increases the profit to "light" hens.

Third, it increases the number of eggs produced.

Fourth, it gives more eggs at the season of high prices.

Fifth, it costs somewhat more to feed the layers.

Sixth, there is more work to care for them "under lights."

Seventh, it does not increase the winter molt of pullets.

Eighth, it does make hens and pullets molt earlier in summer.

Ninth, it decreases the number of eggs per hen at incubation time, but it increases fertility and hatchability, also "livability" of the chicks.

Tenth, it molted fifty per cent of the flock at a time when market eggs were cheapest.

Eleventh, it divides the profits more evenly across the year, which is an advantage.

Twelfth, it made the July and August molters pay a bigger profit than the November and December molters.

In conclusion, I would say that I am a convert to "lights" and will begin October 1st, 1919, again, in the case of all of my flock. At present in this neighborhood there are fifteen local egg producers that are using lights as a result of our success and I can say that last winter all found it profitable.

Yours very truly,
(Signed) C. H. PALMER.

Letter of Lloyd J. Blackmore, Breeder of S. C. White Leghorns, Akron, New York

Akron, New York, August 25, 1919.

Editor Reliable Poultry Journal:

Yours of the 29th at hand and I will say that I have used acetylene lights on my fowls to very good advantage. Did so the past winter and here are the percentages of egg yield from about 200 birds "under lights." I turned on the lights October 15th, 1918.

Percentages of egg yield: November, 17 per cent; December, 24 per cent; January, 28 per cent; February, 42½ per cent; March, 40 per cent.

One hundred of these birds were pullets and the rest were yearling hens. The yearlings began laying about February 1st.

I have read the articles on artificial lights in your Journal with great interest.

Yours truly,
(Signed) LLOYD J. BLACKMORE.

Letter and Report of William A. Crandall, Kendall, New York

Kendall, New York, August 27, 1919.

Editor Reliable Poultry Journal:

In reply to your letter of July 29th, relative to artificial lighting for poultry, I enclose a copy of the Orleans County (New York) "Farm Bureau News" (published monthly by the Orleans County Farm Bureau Association) of date March 1919, on pages two and three of which you will find an article by me on "lights" which will answer some of your questions.

The gas lantern first used by us was the "Coleman", match lighting, two mantle. Later we used the "Air-O-Lite" alcohol generator, having one mantle.

Lights with us were gradually discontinued January 1st, shortening the time five minutes a day. The flock of pullets mentioned in the "Farm Bureau News" compared with my flock of the winter before—same number of birds, hatched April 2nd—produced over 200 per cent more eggs during the winter months.

In the use of "lights" I was very careful to make all changes gradually and at no time to force for extreme production, consequently their highest one-day record was 105 eggs, or 70 per cent plus. This was much lower than some others obtained, but my birds did not drop below 40 per cent production any time during the spring and I know of "lighted" flocks in this vicinity that went as low as 20 per cent.

We expect to "light" again this year, using gas lanterns on 400 pullets and a few August and September molting hens.

Yours truly,
(Signed) WM. A. CRANDALL.

Following is the article by Mr. Crandall, as same was published in the March, 1919, issue of the "Farm Bureau News", Albion, New York:

Poultry House Lighting Produces Results in Orleans County

By W. A. Crandall, Kendall.

Egg record of 148 S. C. W. Leghorn pullets, November 1st to February 1st.

Month	No. Hens	No. Eggs
November	148	533
December	148	2441
January	148	2734
Total		5708

Average net price per doz., 69 cents. Value, $332.65.

These pullets were hatched May 1st, 1918, and were placed in winter quarters October 18th. Previous to this time they had laid from one to two eggs per day for about a week. One hundred and fifty-one pullets were raised but three were culled out when placed in winter quarters. Lighting was commenced November 10th, about three weeks after they were shut up. On this date they laid seven eggs. We began lighting with one 300 c. p. gasoline lantern for a pen 24 feet by 24 feet, about two weeks later adding another 300 c. p. lantern as one did not light that size space suitably. A decided improvement in egg production and also in appearance of birds was noted in about ten days. The flock increased production steadily each day from then on, reaching a production of over 90 eggs December 18th and to this date, February 1st, have averaged better than 90 eggs, or over 60 per cent for every day since, and at present are averaging over 95 eggs per day. It is thought that had lighting been commenced October 18th instead of November 10th full production would have been reached by December 1st instead of December 18th.

Eggs are shipped to New York city where white eggs command a premium over brown or mixed. The small eggs were not sorted out. Eggs sold from this pen during December and January amounted to over $2.00 per bird.

As should be noted, it is difficult to say how much credit may be given the lighting and how much to a mild winter, feeding and care, and to a good strain of layers. A good-laying strain is considered of utmost importance. These pullets were reared from heavy-egg-strain cockerels mated to a flock of over 200 hens that for weeks and weeks last summer averaged to lay better than 65 per cent production. From this flock have been saved 100 late molters, all molting after October 1st. They were selected by Prof. Hurd of Cornell Agricultural College

and according to his advice these breeders will within a few days have their working day lengthened by lighting. It is expected by the use of lights to have them laying well before March 15th, thus furnishing hatching eggs in sufficient amount to commence incubating extensively by that date. Eggs from the pullets will not be used for hatching.

Of course it is understood that as far as market eggs are concerned the use of artificial lights is not primarily to get more eggs per hen per year but to produce more during the winter months when many flocks are not paying their board, and eggs sell for relatively high prices.

Details of Time, Operating Expenses, Extra Feed, Etc.

Lights are started at dusk and continued until 8:30 p. m. This hour was arrived at by gradually extending the time for about a month. Lights are not used in the morning. With two lanterns in use during December one quart of gasoline costing 7c per day was burned. For the longer days of January the cost was 6c per day. A rather heavy item of expense was for broken mantles. These cost for the three-month period $2.75. Extra work on account of using lights amounts to 15 minutes per day.

Extra feed consumed is in direct proportion to the extra hours the hens work. It appears that all extra feed consumed is turned into extra eggs. However, feeding costs should be figured on a basis of pounds feed consumed per dozen eggs produced. Geo. Newell of Congress Park, Chicago, Ill., who claims to be the originator of the lighting idea, found that during the year 1913 when no lights were used his hens ate 13.39 lbs. of feed per dozen eggs produced, and during 1914 when lights were used his hens ate 10.92 lbs. of feed per dozen eggs, or 2.47 lbs. less feed per dozen eggs when lights were used.

The night feed is given at 7 p. m. Then fowls are induced to go to roost by removing the high candlepower lights and dimly lighting the pen by hanging up a single kerosene lantern for a few minutes while the litter is being forked over.

The gasoline lantern is considered safer than the ordinary wick-burning kerosene lantern.

General health of the flock is as good or even better than when artificial lights were not used. Eggs laid are large size for pullets and are very hard shelled.

Testing the Use of "Light" in State of Montana

REPORTS FROM W. F. SCHOPPE, PROFESSOR OF POULTRY HUSBANDRY, DEPARTMENT OF POULTRY, AGRICULTURAL EXPERIMENT STATION, UNIVERSITY OF MONTANA--EXPERIMENTS IN AN EARLY STAGE, BUT ARE SATISFACTORY AS REGARDS PRODUCTION AND INCREASED PROFIT--NO DOUBT ABOUT THE HATCHABILITY OF EGGS

WRITING under date June 21, 1919, in reply to a request from editor of R. P. J. for information on the subject, Professor Schoppe gave the following information:

"Your letter asking for information on use of artificial illumination to increase egg production, and other questions has been on my desk for some time, while I have been studying our records with the purpose of giving you some information.

"Concerning the use of artificial light, we started a project last October which was to continue for a year. I can give you a summary only of the winter months. The test involved 120 Leghorn hens of equal breeding, which were carefully selected. These were housed in the same house, under identical conditions, and the birds in the lighted and unlighted pens were fed the same and given the same treatment.

"During the winter months the birds in the lighted pens consumed 5277.8 pounds of feed, which included grain, mash, milk, meat scrap, green cut bone and green food. Cost of feed was $135.77. Light consumed, 162 kw., cost $15.75. They produced 6554 eggs valued at $343.91, leaving a profit, not including labor and investment, of $192.39.

"The birds in the unlighted pen consumed 4851.77 pounds of feed which cost $124.78. They produced 3805 eggs valued at $194.49, leaving a profit, not including labor and investment, of $69.71.

"This experiment was somewhat upset during the month of February, owing to the breaking of our bone cutter. We were unable to feed green cut bone for that month, and the egg production in the lighted pens dropped from 2014 eggs to 996 eggs. At the same time the egg production for the unlighted pens increased from 1214 to 1317 eggs.

"We are interested in the result of this artificial lighting on the hatching quality of the eggs. In this connection permit me to state that our per cent of hatching due to altitude and dry climatic conditions is a great deal lower than would nominally be expected under more favorable conditions. Therefore, the per cent of hatching from these birds will seem unreasonably low, but I do not believe it could be attributed to the effect of lighting.

"During the spring we set 1033 eggs from the lighted pens. Of these 91 or 8.8 per cent were sterile. Six hundred and fifty-three, or 63.3 per cent of the eggs either failed to hatch or produced crippled chicks. We secured 289 normal chicks, or 28 per cent.

"In the unlighted pens at the same time we set 2200 eggs. Of these 389, or 17.7 per cent were sterile. One thousand and forty-three, or 47.4 per cent failed to hatch. We secured 768, or 34.9 per cent normal chicks.

"Regretting the delay in answering your communication, and also assuring you that if we can be of further assistance will be very glad to communicate with you at any time. "Yours truly,

"W. F. SCHOPPE."

Later Letter From Professor Shoppe

Writing again under date of July 22, 1919, Professor Shoppe added the following information:

"Your communication of the 5th inst. received on my return from a trip East. Concerning the experiment with artificial light and the additional information desired, we report the following:

"Sixty-watt Mazda lamps were used to light the pens, using one light to illuminate two pens. The pens were each 8x12 feet divided in the center by a wire partition. The lamp was placed in the ceiling close to the wire netting. This arrangement gave good distribution of light in both pens.

"The lights were turned on at 6:30 and ran until daylight. They were turned on again as soon as it commenced getting dark in the pens and were kept on until 8:30 at night, when they were gradually turned off by use of a dimmer.

"Yours very truly,

"W. F. SCHOPPE."

Report on Use of "Lights" by a Pennsylvania Poultryman

ANOTHER MAN WHO STUMBLED ONTO THE USE OF LIGHTS AFTER HE REALIZED THAT THE WINTER NIGHTS WERE TOO LONG A STRETCH "BETWEEN MEALS" TELLS OF HIS SUCCESS WITH WHITE PLYMOUTH ROCKS--THEY TOOK KINDLY TO THE LIGHTS AND THEIR OWNER FOUND IT HIGHLY PROFITABLE, BOTH WINTER AND SPRING--HE ALSO HAS PRACTICED "CULLING" FOR SEVERAL YEARS

WRITING editor of R. P. J. under date of October 13, 1919, J. N. Stroup of Middleburg, Pa., said, on the subject of the "Use of Artificial Light to Increase Egg Production":

"Now, a word on 'Artificial Lighting for Winter Egg Production.' Some years ago, before ever having read a word about artificial lighting, I owned a flock of several hundred well-bred White Plymouth Rock pullets. They were of laying age and their combs looked nice, but they just would not lay worth mentioning. I fed and cared for them the best way I knew how, but to no avail.

"Finally, in thinking the matter over, I decided that the nights were too long and cold; that the food they consumed during the short days was required to keep up their bodies, leaving no surplus for eggs. With this idea in mind I secured a large lantern and at nine o'clock in the evening I hung it in the hen house and gave them a good mess of scratch feed in deep litter. These birds were given a good feed before dark in the evening and they then filled their crops, but at nine o'clock their crops again seemed almost empty. The first night very few came off the roost for the nine o'clock meal, but the following nights more came down until at the end of a week every bird would get down for feed. In fact, when they saw the light coming toward the house, they would fly down from the roosts and by the time I was in the house every hen was down off the roost, waiting.

"Given the grain feed, they would scratch until the house was so dusty I could scarcely see the hens, often spending an hour or more scratching and singing, before again retiring. Within two weeks the eggs began to come and it continued until my egg yield was the talk of the community. The grocer said I brought more eggs during cold weather than all his other customers combined.

"My White Rock hens continued the remarkable yield until my spring work began, when I felt like going to bed in the evening instead of feeding hens, so I discontinued the lantern operation and within a week the egg yield had almost entirely ceased. I did a little thinking and decided that the egg yield under the artificial light plan was worth more to me than the work I did by getting out early in th morning, so I again tried the old lantern on my flock and to my surprise I soon had the birds back on the job —and I slept a little later in the morning and was the gainer by so doing.

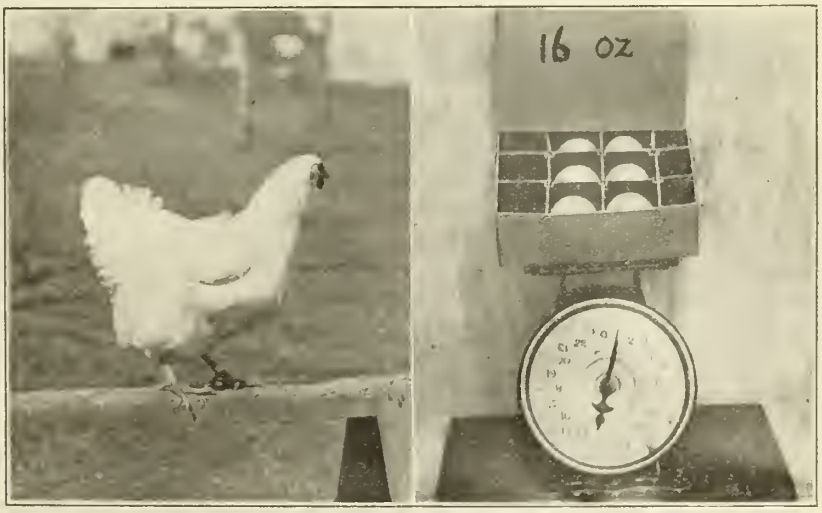
"Later on I bought a good gas lantern which I found highly satisfactory, but shall soon have the laying house equipped with electric lights with a switch ready to hand in my residence.

"Have been particularly interested also in 'poultry culling' and I know you are getting out a book on that subject. Have made a practice of culling my fowls on a business basis for a number of years, and other parties in this vicinity for whom I have culled have been loud in their praises of this money-saving work. I culled 120 birds for one poultry fancier and he felt that he could not bear to market the 70 birds I threw out, so he decided to give them good care and to trap nest them for a year. He did so, and at the end of the year he wrote me that the highest record made was one hen of seventy eggs, while the average was thirty-three eggs per hen for the year.

"Yours very truly,

"J. NEVIN STROUP."

Editorial Note:—The foregoing is an interesting illustration of how thoughtful, practical poultry keepers in various parts of the country have not only found the use of lights effective in producing better egg yields during the short days of fall and early winter, but also of how they have independently arrived at the same explanation for the good results secured—namely, that the hens in northern latitudes need a longer day at that season of the year that their digestive and egg-making organs may operate to their full normal capacity. These numerous, widely-scattered, everyday experiences uniformly confirm the experiments made at Cornell and other institutions where the method has been subject to thorough scientific investigation. Clearly, the pullet of right age, in whatever part of the country she may be, is always ready to do her part if the poultry keeper will only make it possible for her to do so.



RESULTS OF BREEDING FOR LARGER HENS AND EGGS

In striving for greater egg production do not overlook the importance of getting EGGS OF STANDARD MARKET SIZE. High egg records or heavy winter production are of only limited practical value if a large proportion of the eggs are so small that they must be sold at a discount. The White Plymouth Rock pullet illustrated above did not begin to lay until she was nearly eight months old, but when ten months old she weighed 8¾ pounds and produced approximately 178 eggs in 229 days, which weighed about 29 pounds. The six eggs shown in the carton were the last six eggs laid consecutively before her photograph was taken. They weighed just 16 ounces, or 2 pounds to the dozen. This shows what can be accomplished by systematic breeding for increased size.

Interview with Dr. E. C. Waldorf at His Home, August 6, 1919

LATEST SUGGESTIONS AND ADVICE FROM THIS PIONEER IN THE USE OF LIGHTS--IMPORTANCE OF MODERATE AND UNIFORM TEMPERATURE AND OF EASILY DIGESTED FEEDS IN SECURING MAXIMUM PRODUCTION--VALUE OF COOKED GRAINS AND HOW TO PREPARE THEM

Report by EDITOR of R. P. J.

SAID Dr. Waldorf in substance near the close of an interview of some length:

"There are three main conditions or factors to be considered in securing maximum egg production from domestic fowl, meaning hens or chickens.

"First, an equatorial day. By this I mean twelve hours of light as a workday, feeding day or functioning period, and twelve hours of rest. From this equatorial day of twelve hours of light and an equal period for rest on the part of the fowl the period of daylight, natural and artificial, can be increased to sixteen hours of light as compared with eight hours of darkness. Am not prepared to say what division will give the maximum egg yield. It may be that sixteen hours of light and eight hours of dark will do this. I really would reach that conclusion as a result of my experiments twenty-five to thirty years ago, as previously reported in the Reliable Poultry Journal, also as reported at the time in the weekly newspaper of Clyde, N. Y.

"Second, a moderate and uniform temperature in the poultry house or laying quarters. This important point also was covered in the article I wrote for your Journal four or five years ago and was again emphasized in our interview some months ago. There are physiological reasons for this requirement, and poultrymen who make a study of the problem and wish to obtain full advantage, will find that a moderate and uniform temperature is necessary for best results.

"Third, are easily digestible foods of the right ingredients, together with cooked (boiled) grains and a liberal supply of green food. Food in this case, of the definite kind, is the material from which the hen must manufacture the egg—the maximum number of eggs that we are seeking to obtain in any given length of time, notably in the fall and winter during the short-day period of the year when these eggs, as a rule, are scarce and, therefore, bring top prices for human consumption. A statement like this should not need or require elaboration—it is too self-evident. I gave a good deal of study to this matter of balanced rations and the preparation of poultry foods, so that my layers could make the best use of what they ate, including a constant supply of tepid water, and I attribute to this fact, along with the longer workday, the remarkable results obtained."

Next Dr. Waldorf told of his efforts to secure copies of the "Clyde Weekly Times" of Clyde, N. Y., published back in 1893 or 1894, in which the editor reported on the "light experiments", as carried on by Dr. Waldorf in 1889, 1890, 1891, 1892, and 1893 at his home in Buffalo, 496 Porter Ave., where Dr. Waldorf still resides and where this interview took place. Dr. Waldorf built this home in 1884 and has lived there ever since. He gives the names of several neighbors who knew about his poultry experiments, several of whom still live there. He also stated that he had recently visited the offices of the Buffalo Gas Company and found that their records showed that gas manufactured and supplied by them had been piped to his "chicken shed" in 1891.

"Previous to this for two or three years I had used lanterns—kerosene lanterns—but they were not as good as the gas argand burners. There, of course, were no electric lights in those days."

Continuing his discussion of proper feeding for egg production, Dr. Waldorf said in substance:

"Yes, I cooked the grain, that is boiled it well—the oats, wheat, etc. These grains, all of good quality, were put in boiling water at 4:00 p. m. the day before they were to be used and were kept simmering until fed the next day as part of a crumbly dry mash, not wet or too moist. Sometime when I have the leisure, I will be glad to write an article or open letter for R. P. J. or one of your numerous poultry books on the subject of what to feed, how to cook, also how to feed the kind of nutritive materials that will be easiest for the hen to handle, and that will result in eggs of right specific gravity to hatch chicks that will get out of the shell on time, that will live when given a reasonable chance, and that will grow rapidly to maturity under proper management."

Artificial Lighting as a Means of Increasing Egg Production

REPORT OF FIRST EXPERIMENTS MADE IN THE USE OF LIGHTS ON BROAD ACRES POULTRY FARM, WEST CHESHIRE, CONN.--EXPERIMENTS WERE LIMITED, YET PROF. JONES ENDORSES LIGHTING AND PRONOUNCES IT "REALLY A PART OF THE FEEDING PROBLEM"--GOOD AVERAGE PRODUCTION OF HENS AND PULLETS

By ROY E. JONES, Poultry Instructor, Connecticu Agricultural College, Storrs

PRACTICALLY every up-to-date poultryman who has not tried artificial lights as a means of increasing egg production is wondering whether it will not pay him to install some kind of a lighting system. Results from artificial lighting have invariably been very satisfactory for the time and often beyond the wildest dreams. The annual egg production has, however, remained about the same, so it seems, while in same cases it has decreased. Transferring egg production from the season of low prices in the spring to the season of high prices in the fall and winter has usually been the cause of greater cash returns rather than increased production. The old saying, "You cannot eat your cake and have it too" usually holds good but there sometimes are exceptions.

Figures on egg production obtained from Broad Acres Farm of West Cheshire, Connecticut, indicate that it may be possible to nibble the cake a little and still have it. In other words, artificial lights moderately used may be a means of increasing egg production during the season of highest prices and still not reduce production during the remainder of the year. Egg production depends primarily on the amount of surplus nourishment in the hen's body over and above that required for maintenance. When lights are used simply as a means of allowing the hens to eat a normal amount of food and make a reasonable production during the shortest days rather than forcing for abnormal production, the remainder of the year's production is not interrupted.

At Broad Acres Farm the stock is all White Leghorns. The pullets were hatched the latter part of April and May

and grown on a range where shade and green food were abundant. A few eggs were picked up on the range during September and October, but the pullets were not put in winter quarters until November 1, 1918. The pullets were divided into two flocks of 225 each, there being about three to four weeks difference in comparative maturity. The first normal wave of production from the most mature pen with ordinary care and management lasted about six weeks. It was not until the middle of December that the lights were used, at which time a few scattering feathers were seen in the pen, indicating that some of the earliest laying pullets were getting short of food and threatening a partial molt. The lights used were three-hundred c. p. gasoline lanterns. The time of lighting was from 5 a. m. until daylight, no lights being used at night.

The application of lights in moderate amounts at this time did not give an increase in production, but rather held production over a period when there would have been a drop had the lights not been used. The fall molt was checked however, and there was no further evidence of shedding feathers.

The second lot of pullets, maturing a little later, was treated the same way, the lights being used when the first evidence of molt indicated that they were necessary. There was also on the plant a pen of 228 yearling hens. The hens were the best, selected from a flock of 650 which averaged 167 eggs per hen during the previous year. They were all laying November first and less than ten per cent showed any signs of molt. Their production necessarily dropped low in December and January during the molt, but increased at once when a slight amount of light was applied in January, after a reasonable amount of time had been allowed for rest. All lights with both hens and pullets were discontinued after the middle of March.

A careful study of the egg record shows several facts worthy of consideration.

1. While good egg production was obtained during the fall and winter, it was not phenomenal or startling.

2. That artificial lights may be used as a means of stopping a fall or winter molt, or for hurrying late-molting breeding stock into laying for early hatching.

3. Where a minimum amount of artificial light is used simply as a means of keeping the hens in good physical condition, a fairly even lay and a high average egg production can be obtained.

The object of this article is to show that light may be used in a limited way without affecting production later in the season, **and that lighting is really a part of the feeding problem** and should be treated as such in order to avoid overstimulation; that after all, egg production per hen per year or total egg sales per hen per year, is the objective rather than massed production during a short season of highest prices. Just how much light may be used and not affect later production is still an open question, but the beginner had better err on the side of too little artificial light rather than too much.

Record of Production

	228 Yearling Hens		450 Pullets	
	Av. eggs per hen per month	Total eggs to date	Av. eggs per hen per month	Total eggs to date
Nov.	7.8	7.8	5.8	5.8
Dec.	2.0	9.8	11.9	17.7
Jan.	2.2	12.0	12.8	30.5
Feb.	12.5	24.5	14.4	44.9
Mar.	20.0	44.5	19.3	64.2
Apr.	20.2	64.7	19.0	83.2
May	19.5	84.2	20.0	103.2
June	17.3	101.5	17.5	120.7
July	16.4	117.9	16.6	137.3
Aug.	17.4	135.3	17.4	154.7
Sept.	15.6	150.9	14.3	169.0
Oct.	not completed	(163.0)		(180.0)

Figures are kept on the basis of eggs per hen per month rather than per cent production—first, because it is easy to figure even with a changing number of hens in the flock and, second, because it allows keeping a record of the average egg production per hen to date, which is a most valuable record at any time of year for judging the worth of a hen. The production for October is not completed, but will not vary more than one or two eggs from the above totals.

Storrs, Conn., Oct. 20, 1919.

Report of Lighting Tests at Ontario Agricultural College

HEREWITH ARE GIVEN RESULTS OF A ONE-YEAR EXPERIMENT IN THE USE OF LIGHTS--SEVERAL PENS OF PULLETS AND HENS WERE EMPLOYED IN THE TESTS--AS TABLE SHOWS, LIGHTS DID NOT ALWAYS RESULT IN INCREASING TOTAL EGG YIELD, BUT IN EVERY CASE GAVE GREATLY INCREASED PRODUCTION DURING THE FALL AND WINTER MONTHS

TABLE presented herewith gives the results of a one-year experiment conducted by Prof. W. R. Graham, head of the Poultry Department at Ontario Agricultural College, Guelph, Canada, which experiment was concluded October, 1919. Sixteen pens, each consisting of twenty-five pullets, or an equal number of hens, were employed in these tests. As is clearly shown by the table, lights gave excellent results in fall and winter production in every case.

The pens of White Leghorn pullets were the only lighted pens continued throughout the summer that did not give a better average for the year than the check pens without lights. In each case, however, the lighted pens maintained their lead throughout the high-price months. During the low-price season (March to May) the unlighted pens were ahead, and in the case of the Leghorn pullets these pens maintained their lead through the remainder of the test. The lighted pens of Leghorn hens and Barred Rock pullets, however, again took the lead in June or July when prices were on the up-grade. Prof. Graham has not furnished figures showing the exact increase in value of eggs secured as a result of the use of lights, but it is plain that the product of the lighted pens must have had a much higher market value for the year than that of the check pens without light.

TABLE SHOWING RESULT OF EXPERIMENTS IN USE OF LIGHTS AT ONTARIO AGRICULTURAL COLLEGE

	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Total	Average
50 April hatched White Leghorn pullets—lights	664	954	911	691	694	548	336	466	774	357	335	175	.....	6905	138
50 April hatched White Leghorn pullets—no lights	395	697	642	406	508	839	932	982	953	605	613	312	.....	7884	157.7
30 yearling White Leghorn hens—lights	413	460	421	185	169	266	304	365	611	492	475	137	.....	4298	143
30 yearling White Leghorn hens—no lights	284	170	88	83	98	299	521	517	491	235	336	177	.....	3299	109
50 May hatched Barred Rock pullets—lights		573	963	615	667	858	589	684	883	634	731	508	316	8021	160.4
50 May hatched Barred Rock pullets—no lights		131	548	532	415	1009	851	673	921	637	667	447	310	7141	142.8
50 yearling Barred Rock hens—lights	324	543	735	445	415	518	331	513	Pens broken up May 31st					3824	76.4
50 yearling Barred Rock hens—no lights	247	294	449	211	313	764	500	547						3325	66.5

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